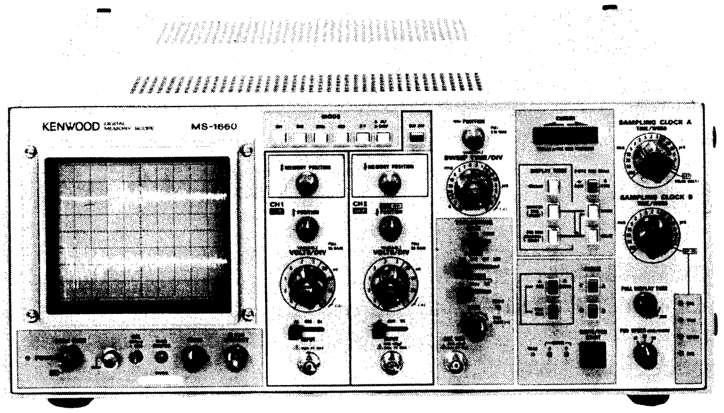
KENWOOD

DIGITAL MEMORY SCOPE

MS-1660

SERVICE MANUAL

KENWOOD CORPORATION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WARNING

1. The following instructions are for use by qualified personnel only. To avoid electric shock, do not perform servicing other than contained in the operating instructions unless you are qualified to do so.

2. High voltage up to 60000 volts dc is present when the oscilloscope is operating. Line voltage (100 to 240 VAC) is present on the power transformer, on-off switch, fuse holder, and line voltage selector any time the oscilloscope is connected to an ac power source, even if turned off. Always observe caution when the housing is removed from the unit. Contacting exposed high voltage could result in fatal electric shock.

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SPECIFICATIONS

CRT

Model:	150 FTM31: Rectangular, with internal graticule
Acceleration voltage:	6 kV
Display area:	8 × 10 div (1 div = 10 mm)

VERTICAL AXIS (Common to CH1 and CH2)

Sensitivity:	1 mV/div to 5V/div ± 3%
Attenuator:	5 mV/div to 5V/div 1-2-5 sequence, fine adjustment between 10 ranges
Input impedance:	1MΩ ± 2%, Approx. 25 pF
Frequence responce:	
DC:	DC to 20 MHz (Within − 3 dB at 5mV/div to 5V/div) DC to 10 MHz (Within − 3 dB at X5 GAIN)
AC:	5 Hz to 20 MHz (Within − 3 dB at 5 mV/div to 5 V/div) 5 Hz to 10 MHz (Within − 3 dB at X5 GAIN)
Rise time X1:	Less than 17.5 ns
X5 GAIN:	Less than 35 ns
Crosstalk:	Less than − 40 dB (CH1 & CH2 in same range)
Operating modes:	
CH1	CH1, single trace
CH2	CH2, single trace
DUAL	CH1 and CH2, dual trace
ADD	CH1 + CH2 (added) display
ALT	Dual or quad trace alternating
CHOP	Dual or quad trace chopped
X-Y	X-Y oscilloscope
CHOP frequency:	Approx. 250 kHz
Polarity reversal:	Available for CH2 only
Maximum input voltage:	500 Vp-p or 250 V (dc + ac peak)
Maximum undistorted amplitude:	8 div, minimum (DC to 20 MHz)

HORIZONTAL AXIS (Channel 2 input, except X10MAG)

Modes:	X-Y mode is switch selectable CH1: Y axis CH2: X axis
Sensitivity:	Same as vertical axis (CH2)
Input impedance:	Same as vertical axis (CH2)
Frequency response:	
DC:	DC to 1 MHz (Within − 3 dB)
AC:	5 Hz to 1 MHz (Within − 3 dB)
X-Y phase difference:	Less than 3° at 100 kHz
Maximum allowable input voltage:	Same as vertical axis (CH2)

SWEEP

Sweep:	NORM; Trigger sweep AUTO; Automatic free run function while signals are not fed
Sweep time:	0.2 μs/div. to 0.5 s/div ± 3%, in 1-2-5 sequence with in 20 ranges, fine adjustment between 20 ranges
Sweep magnification:	X10 ± 5%
Linearity:	± 3% (0.2 μs/div ± 5% with X10 magnification)

TRIGGERING

CH1:	Triggered with vertical input signal on CH1.
CH2:	Triggered with vertical input signal on CH2.
EXT:	Triggered with external synchronizing signal.
LINE:	Triggered with line frequency
External triggering:	
Input impedance:	1 MΩ ± 2%, Approx. 25 pF
Maximum input voltage:	50 V (DC + AC peak)
Coupling modes:	AC, HFREJ, DC
Sync sensitivity	

SYNC COUPLING	SYNC. FREQ. RANGE	MIN. SYNC AMPLITUDE (VOLTAGE)	
		INT	EXT
DC	DC ~ 20 MHz	1 div	0.1 Vp-p
AC	10 Hz ~ 20 MHz	1 div	0.1 Vp-p
DC HFREJ	At 1.5 kHz or over, min. amplitude (voltage), required for sync increases.		

PROBE CALIBRATING VOLTAGE

0.5 V ± 2% of positive square wave, approx. 1 kHz

INTENSITY MODULATION

Input voltage:	Intensity increases with TTL level.
Input impedance:	Approx. 10 kΩ
Frequency range:	DC to 5 MHz
Maximum input voltage:	50 V (DC + AC peak)

VERTICAL AXIS OUTPUT

	CH1 signal output
Output voltage:	Approx. 50 mV/div (50Ω load)
Output impedance:	Approx. 50Ω
Frequency response:	
X1:	100 Hz to 20 MHz (within ±3 dB), at 50 Ω load
X5 GAIN:	100 Hz to 10 MHz (within ±3 dB), at 50 Ω load

GATE OUTPUT

Output waveform:	Positive pulse triggered to sweep
Output voltage:	TTL level
Series resistance:	Approx. 220 Ω

DATA CONVERTER

Converting method:	Successive comparison, A/D converter
Resolution:	8 bits (0.4%)
Frequency response:	DC to 250 kHz (within — 3 dB)

MEMORY

Memory capacity:	8 bits × 2048 words/CH × 2 (Full memory capacity of 4096 words)
Memory devices:	C-MOS static RAMs
Write speed:	1 μs to 100 ms/word, with 1-2-5 sleps in 16 renges (with independent channel setting)

SPECIFICATIONS

Read speed	
INT:	MEMORY OUT: 1 μs/word (fixed) SCOPE: 1 μs/word (fixed) FOR PEN: 10, 20, 50 ms/word (3 ranges)
EXT:	TTL level, repetitive square wave of less than 1 MHz High-level pulse width; More than 500 ns Low-level pulse width; More than 500 ns Rise time; Less than 500 ns
FREEZE function:	Rewrite-protectable for each channel
Memory backup:	Full memory holding. Holding time of more than 200h.

OPERATING FUNCTIONS

REFRESH: (TRIG START)	Write is started with the trigger signal (or manually). Write prohibition variable time between 1 to 20 sec (DISPLAY TIME)
PRE TRIG: (MANUAL START) DELAY:	A write is started manually. Performs pretrigger operation (negative delay) according to cursor setting. Automatic, repeated write/read operations are available (read time can be set from approx. 1 to 20 sec.) Address is simultaneously displaed in other channel.
Cursor setting	Cursor is continuously movable within addresses between 2 and 2000 words. Shifting resolution 1 word (speed variable in 2 steps)

DATA OUTPUT

D/A converter:	8-bit resolution
Output level:	MEMORY OUT: 1.6 $V_{P\text{-}P}$ ± 3% relative to input full scale FOR PEN: 2.0 $V_{P\text{-}P}$ ± 3% relative to input full scale (Over 1 kΩ load)
Output impedance:	MEMORY OUT: Approx. 22 Ω

CONTROL OUTPUT

READ GATE OUT	
Output waveform:	Positive pulse equivalent to 1 word of last address
Output voltage:	TTL level (Common to both channels)
Series resistance:	Approx. 220 Ω

READ GATE OUT FOR PEN

Control signal for PEN	
Output signal:	Negative logic (activated about 2 sec after pen start ON)
Output voltage:	TTL level
Series resistance:	Approx. 220 Ω

EXTERNAL CONTROL

The data in memory is controllable via GP-IB.

Governing standard:	IEEE STD 488-1978
Subsets to be used:	SH1, AH1, TE0, LE0, T6, L4, SR1, RL1, PR0, DC1, and DT0

POWER SOURCE

Line voltage:	100/120/220/240 Vac ± 10% 50/60 Hz
Power consumption	Approx. 70W

DIMENSIONS

Width	426 mm (433 mm)
Height	177 mm (190 mm)
Depth	411 mm (475 mm) Figures in ( ) includes projecting parts.

WEIGHT	Approx. 13 kg

ENVIRONMENT

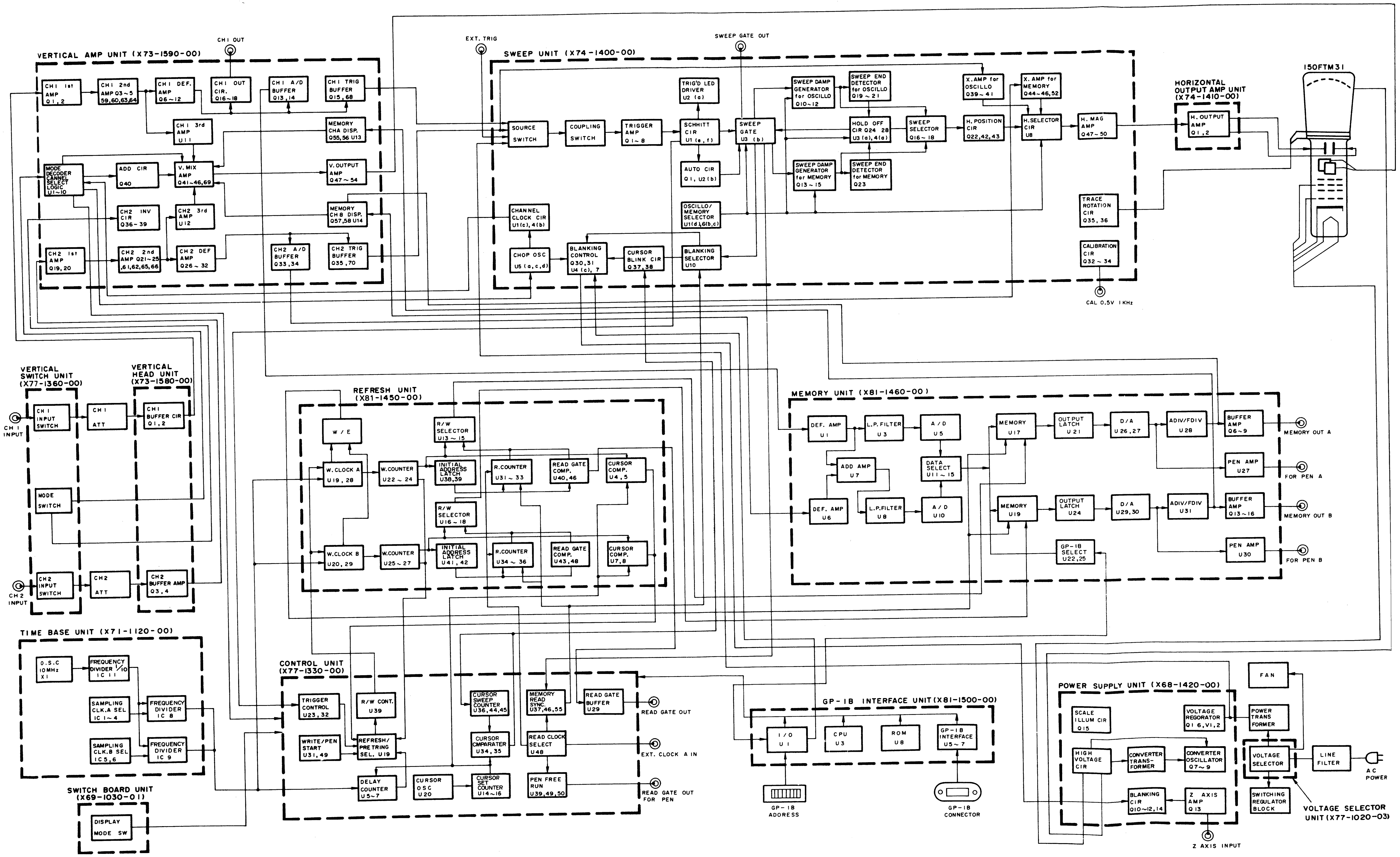
Operating temperature and humidity for guaranteed specifications:	10 to 35°C, 85% RH max.
Full operating temperature and humidity range:	0 to 45°C, 85% RH max.

ACCESSORIES

Probe (PC-20)	2
Attenuation:	1/10, 1/1
Input impedance:	1/10: 10 MΩ, below 18 pF 1/ 1: 1 MΩ, below 100 pF
Instruction manual:	1
AC power cord:	1
Replacemen fuse:	1

OPTION	GP-IB cable (CB-2420P)

BLOCK DIAGRAM


VERTICAL AMP UNIT (X73-1590-00)
CH1 OUT
CH1 1st AMP Q1, 2
CH1 2nd AMP Q3~5 59,60,63,64
CH1 DEF. AMP Q6~12
CH1 OUT CIR. Q16~18
CH1 A/D BUFFER Q13, 14
CH1 TRIG BUFFER Q15, 68
CH1 3rd AMP U11
MEMORY CHA DISP. Q55,56 U13
MODE DECODER CANNEL SELECT LOGIC U1~10
ADD CIR Q40
V. MIX AMP Q41~46,69
V. OUTPUT AMP Q47~54
CH2 INV CIR Q36~39
CH2 3rd AMP U12
MEMORY CH B DISP. Q57,58 U14
CH2 1st AMP Q19, 20
CH2 2nd AMP Q21~25 ,61,62,65,66
CH2 DEF AMP Q26~32
CH2 A/D BUFFER Q33,34
CH2 TRIG BUFFER Q35,70
EXT. TRIG
SWEEP GATE OUT
SWEEP UNIT (X74-1400-00)
SOURCE SWITCH
COUPLING SWITCH
TRIGGER AMP Q1~8
TRIG'D LED DRIVER U2 (a)
SCHMITT CIR U1 (e, f)
AUTO CIR Q1, U2 (b)
SWEEP GATE U3 (b)
SWEEP DAMP GENERATOR for OSCILLO Q10~12
SWEEP END DETECTOR for OSCILLO Q19~21
HOLD OFF CIR Q24 28 U3 (a), 4(a)
SWEEP DAMP GENERATOR for MEMORY Q13~15
SWEEP END DETECTOR for MEMORY Q23
SWEEP SELECTOR Q16~18
X. AMP for OSCILLO Q39~41
X. AMP for MEMORY Q44~46,52
H. POSITION CIR Q22,42,43
H. SELECTOR CIR U8
H. MAG AMP Q47~50
TRACE ROTATION CIR Q35, 36
CALIBRATION CIR Q32~34
CAL 0.5V 1KHz
CHANNEL CLOCK CIR U1(c), 4(b)
CHOP OSC U5 (a, c, d)
BLANKING CONTROL Q30,31 U4 (c), 7
CURSOR BLINK CIR Q37,38
OSCILLO/ MEMORY SELECTOR U1(d),6(b,c)
BLANKING SELECTOR U10
HORIZONTAL OUTPUT AMP UNIT (X74-1410-00)
H. OUTPUT AMP Q1, 2
150FTM31
VERTICAL SWITCH UNIT (X77-1360-00)
VERTICAL HEAD UNIT (X73-1580-00)
CH1 INPUT
CH1 INPUT SWITCH
CH1 ATT
CH1 BUFFER CIR Q1, 2
MODE SWITCH
CH2 INPUT
CH2 INPUT SWITCH
CH2 ATT
CH2 BUFFER AMP Q3, 4
REFRESH UNIT (X81-1450-00)
W / E
R/W SELECTOR U13~15
W. CLOCK A U19, 28
W. COUNTER U22~24
INITIAL ADDRESS LATCH U38,39
R. COUNTER U31~33
READ GATE COMP. U40,46
CURSOR COMP. U4, 5
R/W SELECTOR U16~18
W. CLOCK B U20, 29
W. COUNTER U25~27
INITIAL ADDRESS LATCH U41, 42
R. COUNTER U34~36
READ GATE COMP. U43,48
CURSOR COMP. U7, 8
MEMORY UNIT (X81-1460-00)
DEF. AMP U1
L.P. FILTER U3
A/D U5
MEMORY U17
OUTPUT LATCH U21
D/A U26,27
ADIV/FDIV U28
BUFFER AMP Q6~9
MEMORY OUT A
ADD AMP U7
DATA SELECT U11~15
PEN AMP U27
FOR PEN A
DEF. AMP U6
L.P. FILTER U8
A/D U10
MEMORY U19
OUTPUT LATCH U24
D/A U29,30
ADIV/FDIV U31
BUFFER AMP Q13~16
MEMORY OUT B
GP-IB SELECT U22,25
PEN AMP U30
FOR PEN B
TIME BASE UNIT (X71-1120-00)
O.S.C 10MHz X1
FREQUENCY DIVIDER 1/10 IC1
SAMPLING CLK.A SEL IC1~4
FREQUENCY DIVIDER IC8
SAMPLING CLK.B SEL IC5,6
FREQUENCY DIVIDER IC9
SWITCH BOARD UNIT (X69-1030-01)
DISPLAY MODE SW
CONTROL UNIT (X77-1330-00)
TRIGGER CONTROL U23,32
R/W CONT. U39
WRITE/PEN START U31,49
REFRESH/ PRE TRING SEL. U19
DELAY COUNTER U5~7
CURSOR OSC U20
CURSOR SWEEP COUNTER U36,44,45
CURSOR CMPARATER U34,35
CURSOR SET COUNTER U14~16
MEMORY READ SYNC. U37,46,55
READ CLOCK SELECT U48
PEN FREE RUN U39,49,50
READ GATE BUFFER U29
READ GATE OUT
EXT. CLOCK A IN
READ GATE OUT FOR PEN
GP-IB INTERFACE UNIT (X81-1500-00)
I/O U1
CPU U3
ROM U8
GP-IB INTERFACE U5~7
GP-IB ADDRESS
GP-IB CONNECTOR
FAN
POWER SUPPLY UNIT (X68-1420-00)
SCALE ILLUM CIR Q15
VOLTAGE REGORATOR Q1 6, VI, 2
POWER TRANS FORMER
HIGH VOLTAGE CIR
CONVERTER TRANS-FORMER
CONVERTER OSCILLATOR Q7~9
VOLTAGE SELECTOR
LINE FILTER
AC POWER
BLANKING CIR Q10~12,14
Z AXIS AMP Q13
SWITCHING REGULATOR BLOCK
VOLTAGE SELECTOR UNIT (X77-1020-03)
Z AXIS INPUT

1. Circuit Description

1-1. Vertical Switch Unit (X77-1360-00)

The vertical switch unit consists of the input coupling switches of CH1 and CH2, and also the vertical mode selector switches. The input coupling switches are used to change the input coupling method between AC-GND-DC. The vertical mode switches are used to set the CRT display to CH1, CH2, DUAL, ADD, or X-Y, or NORM or INV of CH2. Also, when DUAL is selected, a further selection can be made between DUAL and CHOP.

A priority sequence is allocated to the five modes between CH1 and X-Y. When two or more switches are pressed simultaneously, the mode having the highest priority is selected. The priority sequence going from the highest priority is CH1, CH2, DUAL, ADD, and X-Y. When all the switches are released, CH1 is selected.

1-2. Vertical Attenuator Unit (S02-4503-05)

The input attenuator of this oscilloscope has three stages. The attenuation ratio of the first stage is 1/100, that of the second stage is 1/10, and that of the third stage 1/2 or 1/4. By combining these attenuation ratios, a 1, 2, or 5 step 10-point input attenuation ratio can be obtained.

This attenuator consists of resistors and capacitors alone. It does not vary the gain of the amplifier. Consequently, there is no need to adjust the step attenuator balance.

1-3. Vertical Head Unit (X73-1580-00)

The signal which is output from the attenuator enters the vertical head amplifier, where impedance conversion is performed by a source follower and emitter follower, and is then fed to the vertical amplifier.

VR1 and VR2 adjust the DC balance in CH1 and CH2, respectively. In this unit, they are used to adjust the balance when the X5 GAIN switch on the vertical amplifier is turned ON and OFF.

1-4. Vertical Amplifier Unit (X73-1590-00)

The vertical amplifier is a 4-channel amplifier system having a dual trace function for the REAL waveform and a dual trace function for the MEMORY waveform.

The signal which comes from the head amplifier is differentially amplified by dual transistor Q1.

By changing the resistance between the emitters of Q1a and b, the amplifier gain is changed to perform X5 GAIN operation. Q3 and the subsequent circuit constitutes the second stage amplifier. This stage contains the vertical variable adjuster and the vertical position adjuster. U11 is the third stage amplifier. This circuit can be turned ON and OFF by the channel selector. It can be selected by the MODE and DISPLAY MODE switches on the front panel.

Q6 to 10 is a common amplifier which generates the trigger signal, CH1 OUT signal, and also the analog signal which is to be sent to the memory unit. These signals are output via Q15, Q16 to 18, and Q13 and 14, to the sweep unit, the output terminals on the rear panel of the oscilloscope, and the memory unit, respectively.

The circuit of CH2 is similar to that of CH1 except that CH2 INV operation takes place when Q22 and 23 are switched over to Q24 and 25. The selector switch which achieves this consists of Q36 to 39.

Q55, 56, and **U13** comprise an amplifier which is used to output the memorized waveform on the A side of sampling clock to the screen. It is provided with a memory position adjuster.

Q57, 58, and **U14** perform a similar function on the B side of the sampling clock. Also, the X signal is sent from here to the sweep unit during memory X-Y operation.

The signals selected by the MODE switch and the DISPLAY MODE switch are mixed at Q41 and 42, amplified by one more stage at Q43 and 44, then fed to the output amplifier. Q40 is an ADD selector switch.

Q47 to 54 constitute the output amplifier which consists of a cascode circuit and a constant current load. The output of this amplifier is connected to the vertical deflection plates of the CRT.

U1 to 10 constitute a circuit which generates a control signal corresponding to each display mode of the oscilloscope and memory selected by the MODE and DISPLAY MODE switches.

1-5. Sweep Unit (X74-1400-00)

The input sync signal is switched to CH1, CH2, EXT, or LINE by the source switch, and the coupling format is set to AC, HF_{REJ}, or DC by the coupling switch. Subsequently, the input sync signal is amplified by the trigger amplifier consisting of Q1 to 8. This amplifier contains a trigger level adjuster and a trigger slope selector. Next, the signal is wave-shaped by a Schmitt trigger circuit consisting of **U1f** and **1e** to become the trigger signal.

In the oscilloscope mode, when the trigger signal enters V3b the gate opens and one of capacitors C13 to 15 which is selected by rotary switch S6 starts to charge, causing the sweep wave to be generated. When the sweep wave reaches the specified level, the comparator consisting of Q20 and 21 detects the sweep wave and emits an output. This output passes through Q19, 24, and **U4a**, causing **U3a** to be inverted. As a result, **U3b** is inverted, the gate closes, and the sweep wave falls. At the same time, the hold-off circuit operates, and one of C21 to 23 starts to charge. When the specified value is reached, **U3a** is inverted via Q28, the hold-off period is ended, and **U3b** waits for the arrival of the trigger.

In the memory mode as well, a similar operation takes place. In this case, however, Q13 to 15 and Q23 operate instead. Also, the sweep and hold-off capacitors are C17 and C22 alone, hence the sweep time is fixed at 0.2 mS/DIV.

U2b, Q9, and **U4d** comprise an auto circuit. When S4 is set to the AUTO side, free-run operation takes place while the trigger signal is absent.

The sawtooth waves of the sweep pass through the position adjusting circuit in Q22, 42, and 43, and enter the horizontal switching amplifier circuit **U8**. Also, the X-axis signal of the oscilloscope is amplified by Q39 and 40, and the X-axis signal of the memory by Q45 and 46. These signals then enter **U8** where either the sweep signal, oscilloscope X-axis signal, or the memory X-axis signal is selected. The output is amplified by Q48, 49, and the horizontal output amplifier, and applied to the horizontal deflection plates of the CRT.

By selecting the resistance between the emitters of Q48 and 49, MAG X10 is obtained. The gate signal, which is synchronized with the sweep signal, passes through **U10**, **U7**, Q30, and Q31 and enters the blanking amplifier of the power supply unit.

Also, Q37 and 38 constitute the amplifier for the cursor brightness modulating signal during memory operation.

U5c and **5d** constitute a chop generator. The chop signal passes through **U4c**, the chop blanking circuit, and **U4b** to become the chop selector signal.

Q32 to 34 constitute a calibration signal generator, and Q33 and 34 constitute an astable multivibrator circuit. The generated signal, which undergoes an impedance reduction at Q32, is output as a calibration voltage.

Q35 and 36 constitute a trace rotation circuit.

1-6. Horizontal Output Unit (X74-1410-00)

The horizontal output unit in combination with Q48 and 49 of the sweep unit comprise a cascode amplifier which outputs a signal to the horizontal deflector plates of the CRT.

1-7. Power Supply Unit (X68-1420-00)

The regulated power supply circuit constitutes a tracking regulator in which an operational amp is used as an error amplifier. Q1 to 4 are control transistors, and **U1a** 1b, 1a, and 2b constitute the error amplifier.

+10 V is generated using zener diode D5 as a reference, − V is generated using +10 V as a reference, and +20 V and +140 V are generated using −10 V as a reference.

The high voltage power supply for the CRT beam acceleration is a feedback-type constant voltage circuit which employs a DC-DC converter consisting of Q7 and T1 and also an error amplifier consisting of Q8 and 9. It generates −1.5 kV using +10 V as a reference. Also, the post-deflection acceleration voltage of +4.5 V is generated by a voltage tripler and rectifier block, D10.

The blanking signal from the sweep unit is amplified by Q10 to 12, DC-restored by D11 and 12, then applied to the CRT grid.

The Z-axis signal is amplified by Q13, then sent to the blanking circuit where the brightness signal is amplified to the TTL level.

Q15 is a scale illumination transistor.

1-8. Control Unit (X77-1330-00)

This unit consists of the memory read and write control circuit for each mode (**U39**), the PEN and pen FREERUN selector circuit (**U50**, **49**, and **39**), the sync circuit for the SCOPE blanking signal (**U46** and **55**), the sync signal circuit for memory read (**U37**), the DELAY counter (**U5**, **6**, and **7**), and the cursor setting counter (**U14**, **15**, and **16**).

Memory write takes place as follows: As a result of the TRIG signal and the manual start, single shot pulses are emitted from monostable multivibrator **U49**, causing flip-flop **U39** to be set. As a result, the $\overline{\text{R}}$/W C signal becomes "H", the write counter of the refresh unit (X81-145-00) starts, and write operation takes place. When the count on the write counter reaches 2048, the $\overline{\text{W/C}}$ signal is output, causing flip-flop **U39** to be reset. This stops write operation Memory read takes place as follows: The SWP signal (2 mS) output from the sweep unit (74X-1400-00) is synchronized with the read clock, and the blanking signal TRIGE generated and output to the sweep unit. At the same time, the $\overline{\text{LOAD}}$ signal which sets the initial address of the read counter of the refresh unit is generated by monostable multivibrator **U37**, and output to the refresh unit.

There are three read clocks, INT (1 μsec/w), EXT, and PEN (10 msec/w to 50 msec/w) which are selected by **U48**.

In the PEN mode, PEN START creates a 2-second PEN operation wait interval in IC **U49**. Subsequently, flip-flop **U39** is set, the PEN mode read operation starts, and when 2048 bytes have been read, the $\overline{\text{DIHA}}$ signal is sent from the refresh unit, U39 is reset, and read is completed.

Also, in the case of PEN FREERUN, as soon as read is completed IC **U49** is operated, and write operation starts. In the PRE TRIG mode, WRITE START causes IC **U49** to operate and enters a write status. At the same time, TRIG ADDRESS (U14 to 16), which was set by the cursor, is set by the DELAY counter (**U5** to 7), thus determining the end of write operation.

The cursor setting section consists of the cursor setting counter (**U14** to 16), cursor read counter (**U44**, **45**, and 36), comparator (**U24** and 25), and oscillator circuit (**U30** and 20). If the cursor switch is pressed, the cursor setting counter counts one pulse. If the switch is pressed continuously, the oscillator circuit operates, and the output pulse drives the setting counter and sets the cursor. Readout of the cursor point is synchronized with the SWP signal and causes the cursor read counter to operate. When the read counter reaches the value of the setting counter, a single shot pulse is emitted from IC **U37**, and a brightness modulation signal is output.

1-9. Refresh Unit (X81-1450-00)

This unit consists of a read counter (**U31** to 36) which determines the address of the memory, write counter (U22 to 27), read/write selector (U13 to 18), initial address register (**U38**, 39, 41, and 42), comparator (**U46**, 40, 48, 43, 4, 5, 7, and 7), and write clock selector timing circuit for low speed/high speed writing (**U19** and 20).

CIRCUIT DESCRIPTION

The write clock is generated by synchronizing the W/CLK signal, which is selected by SAMPLING CLOCK SW and sent from the time base unit (X71-1120-00), with the A/D START signal which is sent from the memory unit (X81-1460-00). The write clock causes the write counter to operate and determines the address during memory write. Also, the W/E signal (U28 and 29) which is necessary for writing to the memory is generated in synchronizm with the write clock. The read counter is operated by the R CLK signal which is sent from the control unit when the start address for reading the memory is determined by the initial address register, and memory read takes place. Also, the read counter and initial address register are compared with each other, and when they match each other, the READ GATE signal is output from U40.

Read/write select is performed by the R/WC signal which is sent from the control unit. For high speed reading in which SAMPLING CLOCK is between 1 μs and 50 μs/WORD, when the R/WC signal is "H", the write counter is selected; when the R/WC counter is "L", the read counter is selected. For low speed reading in which SAMPLING CLOCK is between 0.1 mS and 100 mS/WORD, when the R/W C signal is "H", the write counter is selected in synchronizm with the write clock for exactly 1 μs; in all other cases, the read counter is selected.

The initial address register memorizes the write end address of the write counter by means of the LAS signal generated by the write counter and the delay counter of the control unit, and operates as the start address of memory read.

1-10. Memory Unit (X81-1460-00)

This unit consists of an A/D converter, DATA selector circuit for each mode, memory, GP-IB DATA selector circuit, D/A converter, output amplifier, and memory backup circuit. The input amplifier consists of OP AMPs U1 to 4 and 6 to 9. The input signal sent from the vertical amplifier unit (X73-1590-00) is received by differential amplifier U1and6, Subsequently, this signal passes through a low-pass filter (300 KHz) consisting of U3 and 8, an attenuator amplifier consisting of U4 and 9, and a level shift circuit, to an A/D converter consisting of U5 and 10. The input level of the A/D converter is adjusted to ±0.225 V FULL SCALE centered about -0.25 V.

When the MODE is ADD, FET switch Q3 goes ON, and amplifier U7 adds the signals of CH1 and CH2 which are then connected to the A/D converter on the CH2 side.

The A/D converter free-runs at a frequency of 1 MHz, which is converted into an 8-bit binary code every 1 μSec by the 10 MHz conversion clock, and latched by the register consisting of U11 and 14. The converted digital data passes through the MODE selector circuit consisting of U12, 13, and 15, then is stored in a 2048 word memory consisting of U17 and 19. The bidirectional bus switch U13 operates under the DISPLAY MODE to transfer CH1 data to the CH2 memory, and CH2 data to the CH1 memory.

External data is written or internal data read by GP-IB when the bidirectional bus switch consisting of U22 and 25 goes ON and the memory data bus is connected to the data bus of the GP-IB interface unit (X81-1500-00).

When data memorized in the memory is to be read, it is first latched in the output register consisting of U21 and 24, then converted to an analog signal by the D/A converter consisting of U26 and 29. This signal then passes through a current/voltage converter consisting of U27 and 30 and also a level shift circuit, resulting in an output signal of ±0.8V (1.6 V/F.S.) at TP7 and 9. This output passes through a 4 DIV/8 DIV (0.8V/1.6 V F.S.) switching circuit consisting of U28 and 31, and is sent to the vertical amplifier unit (X73-1590-00) from P3-2 and P6-2 as a SCOPE OUT signal. This signal also passes through a buffer consisting of Q6 to 9 and 13 to 16, and is sent to the MEMORY OUT terminal as a MEMORY OUT signal.

In the PEN OUT MODE, the FET switch consisting of Q5 and 12 is turned ON, the signal is amplified to 2 V/F.S. by the amplifier consisting of U27 and 30, and is then output to the PEN OUT terminal as a PEN OUT signal from P4-2 and P7-2.

Memory back-up operation takes place as follows: When the +5 V power supply voltage falls to about +4.4V, this is detected by the POWER DOWN detection IC U23 which makes the control terminal of the analog switch U18 "L" and connects the back-up power supply for the memory IC.

1-11. Signal Names

<CLOCK signals>

W/CLK A.B	Write CLOCK	W.MODE
R CLK 1.2	Read CLOCK	R.MODE
EXT C	External read CLOCK	R.MODE
100 nS CLK	10 MHZ CLOCK	CLK
1 uS CLK	1 MHz CLOCK	CLK
SWP.SWP'	Sweep gate CLOCK	CLK
W/E A.B	Memory write CLOCK	W.MODE
A/D START	A/D conversion START CLOCK	W.MODE

<CONTROL signals>

R/W C A.B	Read and write control signal	R/W MODE
COMP A.B	Sub-channel write start signal	W.MODE
W/C A.B	WRITE COUNTER STOP signal	R.MODE
LOAD	READ COUNTER PRESET signal	R.MODE
$\overline{\text{DIHA}}$	Read end address signal	R.MODE
$\overline{\text{RGO}}$	Read end address signal	R.MODE
RGOS	READ GATE OUT signal	R.MODE
RGOP	PEN DOWN OUT signal	R.MODE
PAN 1.2	PEN mode control signal	R.MODE
ASP 1.2	PEN mode control signal	R.MODE
ZBC	Cursor bright point signal	R.MODE
EXT.S	EXT CLK control signal	R.MODE
$\overline{\text{PSC}}$	PEN/MONI selector signal	R.MODE
$\overline{\text{WSTR}}$	Manual write start signal	W.MODE
DISTV.$\overline{\text{DIST}}$	DISPLAY TIME control signal	
DC0 to DC10	PRE TRIG COUNTER output signal	W.MODE
ADC	Control signal for add (ADD) mode	W.MODE

CIRCUIT DESCRIPTION

LAS A.B	Initial address latch signal	W.MODE
FZ 1.2	Memory re-write stop signal	
$\overline{\text{PWC}}$	Initial clear at power-on	
$\overline{\text{RFC}}$	REFRESH CONTROL signal	
$\overline{\text{NTC}}$	NORMAL/DELAY select signal	
NTS	NORMAL/DELAY select signal	
MNC	NORMAL/DELAY select signal	
MDC	Memory connecting direction select signal	
A_0 to A_2	Mode select control signal (3 bit)	
TRIG,$\overline{\text{TRIG}}$, TRIG'	Trigger pulse	W.MODE
RNCA,RNCB	Low speed write high speed read	W.MODE
MOC A B	Memory output latch clear signal	R.MODE
ADA00 to 10	A address signal	R/W MODE
ADB0 to 10	B address signal	R/W MODE
MOLA B	Memory output latch CLK	R.MODE
DGC	4DIV/8DIV control signal	R.MODE

UP,DOWN	Cursor control signal	W.MODE
WLEA,WLEB	Write LED control signal	W.MODE
R LED	Read LED control signal	R.MODE
PNCLR	PEN mode memory output latch clear signal	R.MODE
$\overline{\text{WRSTR}}$	Write start signal	W.MODE
PRDEL	Pre-trigger delay control signal	W.MODE
$\overline{\text{DEN}}$	A/D output data select signal	W.MODE
SELT	A/D output data select signal	W.MODE

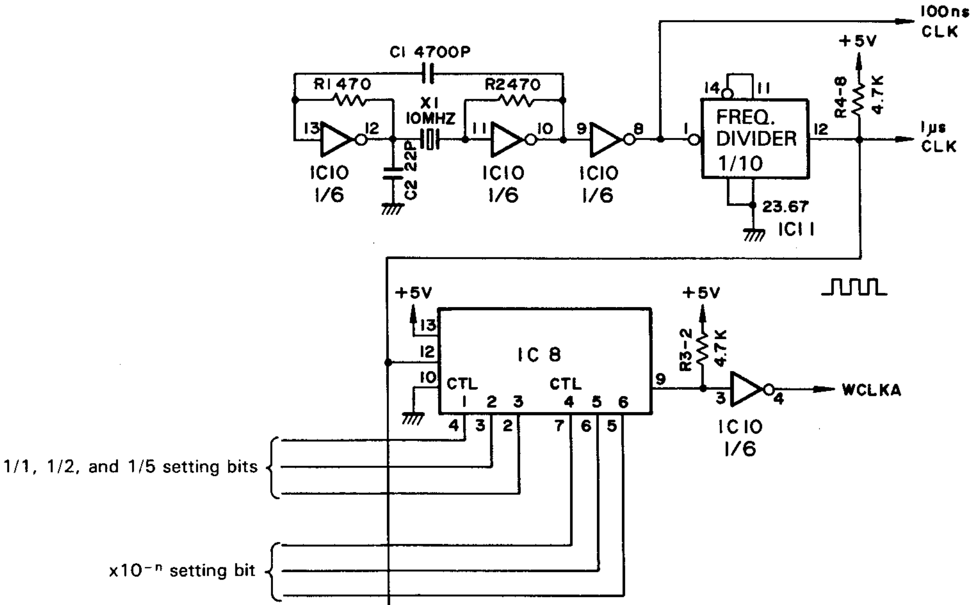
<GP-IB interface signals>

OPEN	GP-IB interrupt control signal
IWRA, B	Memory write enable signal
$\overline{\text{ICEA, B}}$	Data send/receive enable signal
D0 to 7	Memory data signal
$\overline{\text{IRD}}$	Memory data read/write control signal
TWREN	LOCAL write in progress

1-12. Others

(1) CLOCK

(a) CLOCK generator circuit (time base unit)



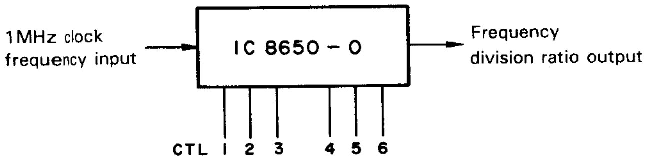
Portion of time base unit

TIME BASE is generated as the frequency-divided output of a 10 MHz crystal oscillator circuit. 100ns CLK of the basic CLOCK is used as a conversion clock of the A/D converter. The 1 uS CLK obtained by 1/10 frequency-dividing IC11 is used for starting A/D conversion, and also as a write counter sync clock and read counter sync clock. The frequency division ratio of the write sampling clock WCLK is determined by control signals CTL1 to 6 which are in turn selected by the frequency division IC, IC8.

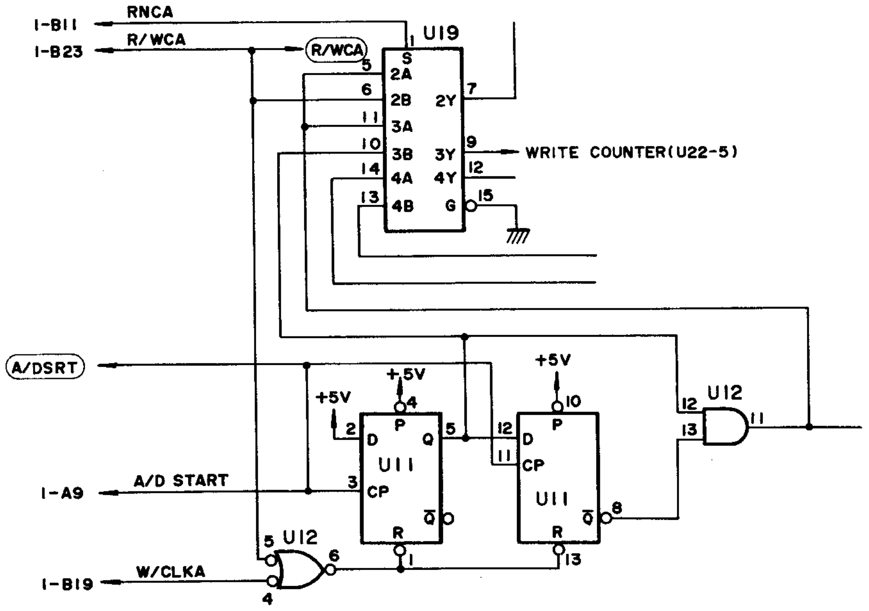
CIRCUIT DESCRIPTION

TIME/WORD	1 MHz clock	CTL 1	CTL 2	CTL 3	CTL 4	CTL 5	CTL 6	Frequency-divided clock output.
1μS	1 MHz	0	0	0	0	0	0	1/1
2	500 KHz	0	1	0	0	0	0	1/2
5	200	1	0	1	0	0	0	1/5
10	100	0	0	0	0	0	1	1/10
20	50	0	1	0	0	0	1	1/20
50	20	1	0	1	0	0	1	1/50
100	10	0	0	0	0	1	0	1/100
200	5	0	1	0	0	1	0	1/200
500	2	1	0	1	0	1	0	1/500
1 mS	1	0	0	0	0	1	1	1/1000
2	0.5	0	1	0	0	1	1	1/2000
5	0.2	1	0	1	0	1	1	1/5000
10	0.1	0	0	0	1	0	0	1/10000
20	0.05	0	1	0	1	0	0	1/20000
50 FOR PEN	0.02	1	0	1	1	0	0	1/50000
100	0.01	0	0	0	1	0	1	1/100000

Relation between control signal and frequency division ratio


1MHz clock
frequency input
IC 8650 – 0
Frequency
division ratio output
CTL 1 2 3 4 5 6

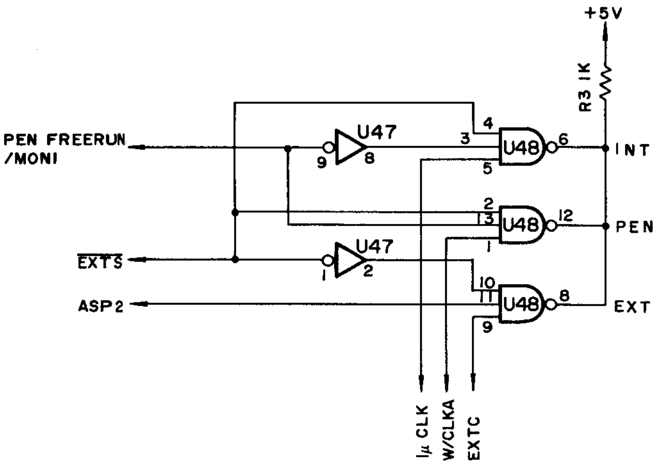
(b) WRITE CLOCK (Refresh unit)


1-B11
RNCA
1-B23
R/WCA
U19
S
2A
2B
2Y
3A
3B
3Y
4A
4Y
4B
G
WRITE COUNTER(U22-5)
A/DSRT
+5V
P
D
Q
U11
CP
Q̄
R
1-A9
A/D START
U12
1-B19
W/CLKA

CIRCUIT DESCRIPTION

WRITE CLOCK is generated by the W/CLK signal sent from the TIME BASE unit and the A/D START signal sent from the MEMORY unit.
W/CLK is synchronized with the leading edge of A/D START, and is connected from U19-9 to WRITE COUNTER.

(C) READ CLOCK (control unit)



+5V
R3 1K
PEN FREERUN /MONI
U47
9
8
3
4
5
U48
6
INT
2
13
U48
12
1
PEN
$\overline{\text{EXTS}}$
U47
1
2
ASP2
10
11
U48
8
9
EXT
μ CLK
W/CLKA
EXTC

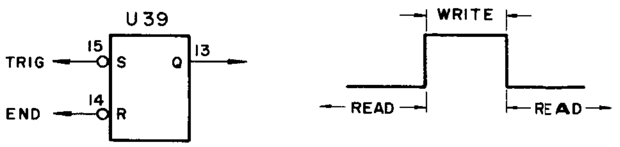
There are three types of READ CLOCK; INT CLOCK, PEN CLOCK, and EXT CLOCK. These can be selected by the open-collector IC, U48.
INT CLOCK is fixed at 1 μS/word, and operates in the SCOPE MODE.

There are three types of PEN CLOCK between 10 mS and 50 mS/word which can be selected by PEN SPEED.
EXT CLOCK is a clock which is input from the EXT CLOCK terminal on the rear panel.

(2) WRITE MODE

Write operation starts when either a TRIGGER signal is input or the WRITE START switch is pressed.
When the DISPLAY MODE is refreshed, the $\overline{R}$/W C signal is made "H" by the TRIG signal sent from the sweep unit. When 2 Kwords of write is completed, the $\overline{R}$/W C signal is made "L" by the W/C signal output from the WRITE COUNTER, causing the READ MODE to be activated.
When the DISPLAY MODE is PRE TRIG and the WRITE START switch is pressed, the $\overline{R}$/W C signal becomes "H", and write starts.
—DELAY COUNTER counts the trigger point set by the cursor. When counting is completed, the $\overline{R}$/W C signal is made "L" by the END signal of —DELAY COUNTER, causing the READ MODE to be activated.

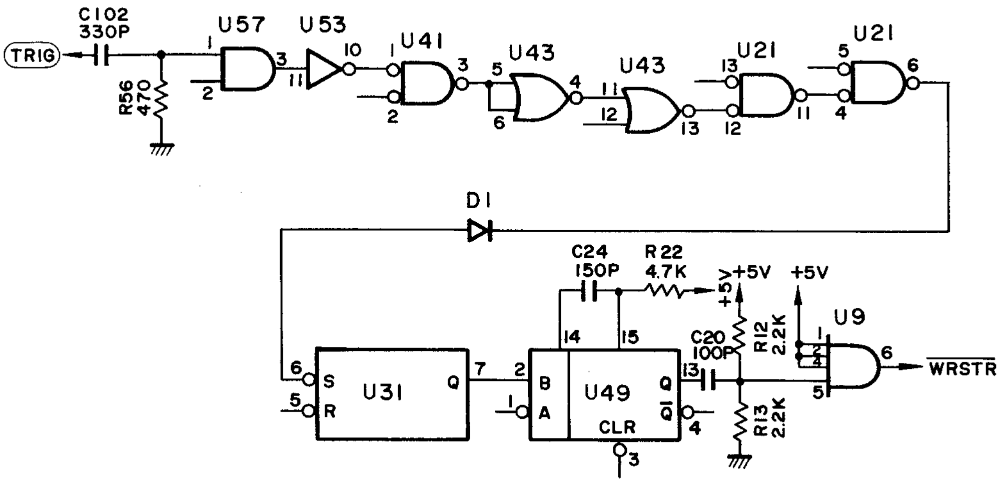
(a) $\overline{R}$/W C (control unit)



U39
TRIG
15
S
Q
13
END
14
R
WRITE
READ
READ

The $\overline{R}$/W C signal consists of R-S FF. It is set by the TRIG signal, and reset by the write end signal.

(b) WRITE START in REFRESH MODE (control unit)

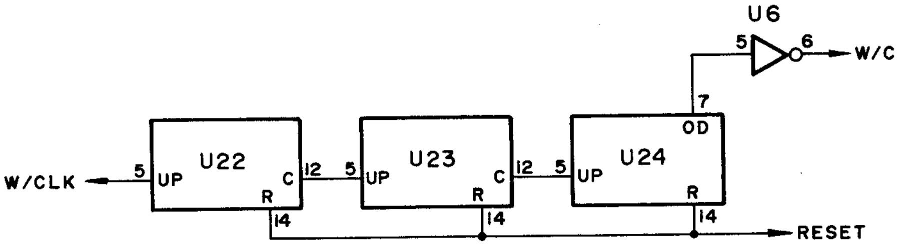


C102 330P
TRIG
R56 470
U57
1
2
3
U53
11
10
U41
1
2
3
U43
5
6
4
U43
11
12
13
U21
13
12
11
U21
5
4
6
D1
C24 150P
R22 4.7K
+5V
+5V
+5V
14
15
C20 100P
R12 2.2K
U9
1
2
4
5
6
WRSTR
6
S
5
R
U31
Q
7
2
B
1
A
U49
CLR
3
Q
13
$\overline{\text{Q}}$
4
R13 2.2K

In the REFRESH MODE, the monostable multivibrator U49 is operated by the TRIG signal, and the output signal is differentiated. Then the $\overline{\text{WRSTR}}$ signal is output from U9-6 and used as a set signal for R/W C signal.

CIRCUIT DESCRIPTION

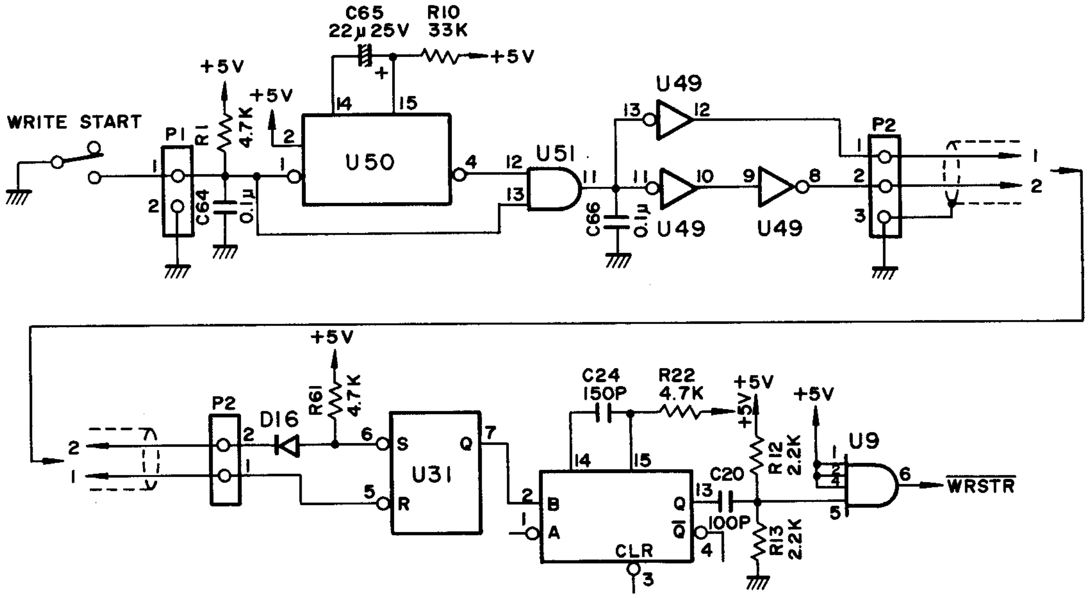
(c) WRITE END in REFRESH MODE (refresh unit)


U6
5
6
W/C
7
OD
W/CLK
5
UP
U22
C
R
12
14
U23
U24
RESET

When the WRITE COUNTER (U22 to 24) completes 2048 counts, it outputs a W/C signal as an END signal. This W/C signal resets the $\overline{R}$/W C signal and ends the WRITE MODE.

(d) WRITE START in PRE TRIG MODE

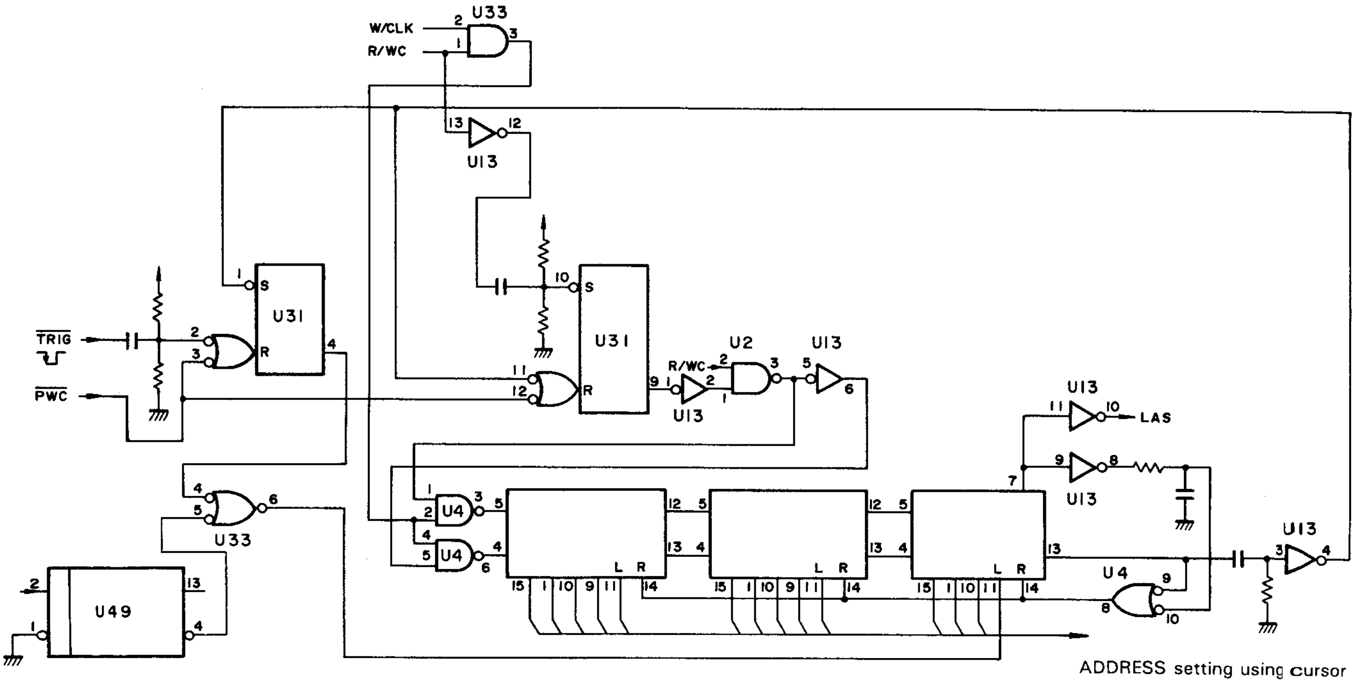
(Refresh unit → control unit)


C65
22μ 25V
R10
33K
+5V
U49
WRITE START
P1
R1
4.7K
C64
0.1μ
U50
U51
C66
0.1μ
P2
D16
R61
4.7K
S
Q
U31
R
C24
150P
R22
4.7K
C20
100P
R12
2.2K
R13
2.2K
B
A
CLR
Q
$\overline{Q}$
U9
WRSTR

In the PRE TRIG MODE, when the WRITE START switch is pressed the control unit IC U49 is operated, causing the set signal of the $\overline{R}$/W C signal to be generated. The circuit in the refresh unit is designed to eliminate chattering caused by the WRITE START switch.

CIRCUIT DESCRIPTION

(e) WRITE END (–DELAY) in PRE TRIG MODE (control unit)



W/CLK
R/WC
U33
U13
U31
S
R
TRIG
PWC
U2
R/WC
U13
LAS
U4
U33
U49
L R
U13
U4

ADDRESS setting using cursor

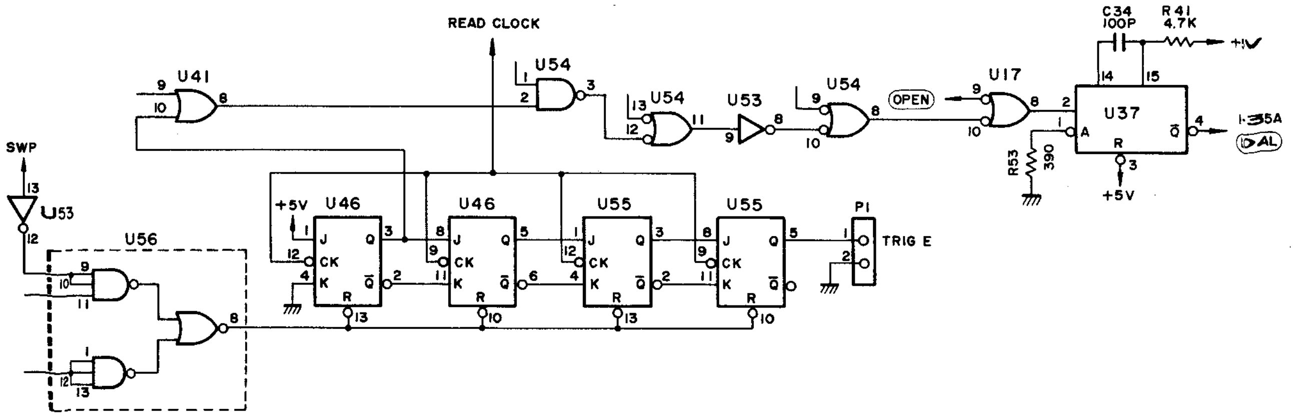
When the WRITE START switch is pressed, a single shot pulse is output from U32-4. This pulse causes –DELAY COUNTER (U5 to 7) to load TRIG ADDRESS by means of the cursor. Next, the W/CLK signal causes DOWN COUNT to start. Upon completion of DOWN COUNT, the system goes into the $\overline{\text{TRIG}}$ signal wait status. When the TRIG signal is input, –DELAY COUNTER is re-loaded, and UP COUNT starts. When the (2048 - cursor setting address) count is completed, the LAS signal is output from U13-10, causing $\overline{\text{R}}$/W C signal to be reset.

(3) READ MODE

Three types of read operation, SCOPE, PEN, and EXT CLOCK, can be selected. In the SCOPE mode, synchronization is automatically applied by means of internal operation. For the other read modes, an external monitor is used. In the case of the PEN mode, a PEN DOWN signal is used as a syncsignal, while for the EXT CLOCK mode, the READ GATE signal is used.

Also, when the SAMPLING CLOCK is between 0.1 mS and 100 mS/word, read takes place simultaneously with write, even when the WRITE MODE is activated.

(a) SCOPE (control unit)

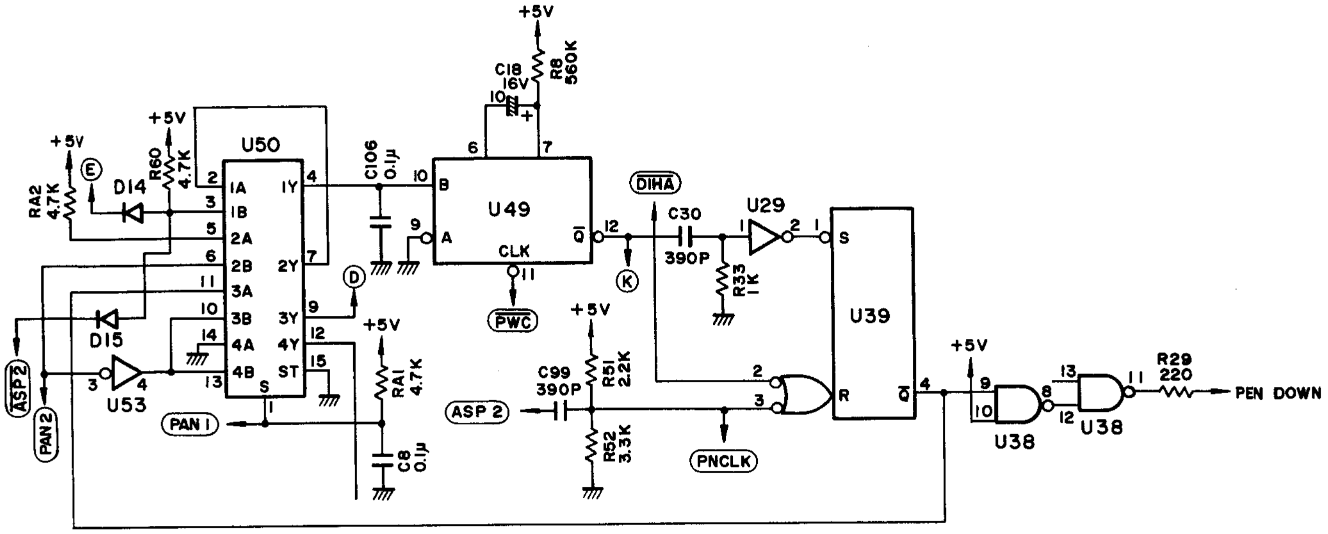


READ CLOCK
C34 100P
R41 4.7K
+5V
U41
U54
U54
U53
U54
OPEN
U17
U37
A
R
Q̄
SWP
U53
R53 390
+5V
U46
U46
U55
U55
P1
TRIG E
U56
J
CK
K
Q
Q̄
R

CIRCUIT DESCRIPTION

The SWP signal generated in the sweep unit and READ CLOCK are synchronized by the sync counter consisting of U46 and 55, causing the TRIGE signal (TRIG_↑‾) to be generated. The LOAD signal which sets the initial address of READ COUNTER (refresh unit) is generated at the leading edge of the U46-3 signal output from U37-4.

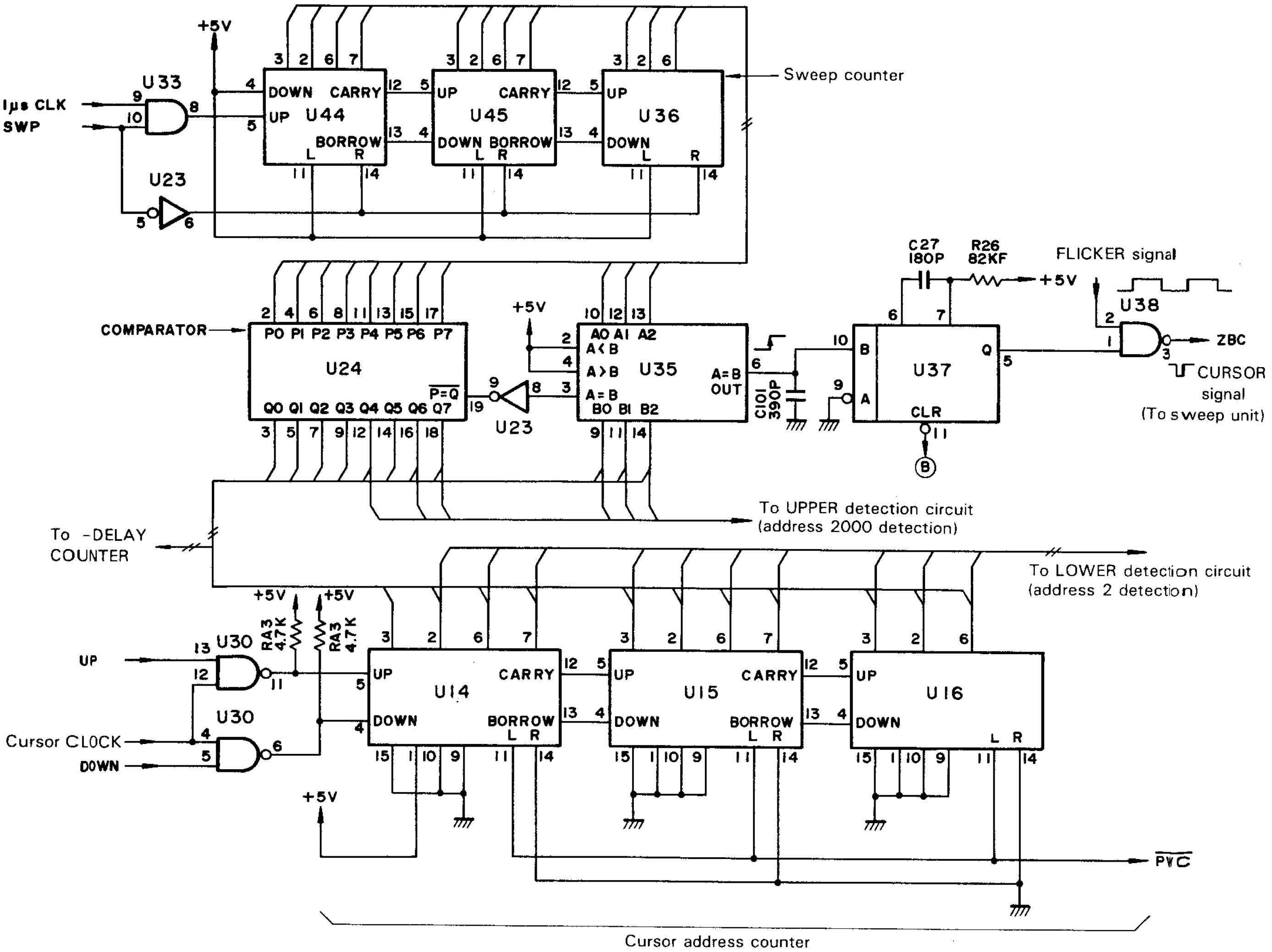
(b) PEN READ (control unit)


+5V
C18
16V
10
R8
560K
+5V
+5V
Ⓔ
D14
R60
4.7K
RA2
4.7K
U50
1A
1B
2A
2B
3A
3B
4A
4B
1Y
2Y
3Y
4Y
ST
S
C106
0.1μ
B
A
U49
CLK
Q̄
Ⓓ
PWC
DIHA
C30
390P
U29
R33
1K
Ⓚ
+5V
+5V
RA1
4.7K
C99
390P
R51
2.2K
R52
3.3K
C8
0.1μ
ASP 2
PNCLK
D15
U53
PAN 1
ASP2
PAN2
U39
S
R
Q̄
+5V
U38
U38
R29
220
PEN DOWN

When the PEN switch is pressed, the $\overline{\text{ASP2}}$ signal becomes "H" and the PEN START SW signal is connected to Ⓔ (_↑‾|_). Next, when the PEN START switch is pressed, a pulse of about 2 seconds (‾|_↑‾) is generated at U49-12. At the leading edge of this pulse, R-S FF of U39 is set, and PEN MODE read takes place. When 2048 words have been output, the $\overline{\text{DIHA}}$ signal from the refresh unit is output, R-S FF of U39 is reset, and the system goes into a standby status. Also, in the PEN FREE RUN mode, the $\overline{\text{R}}$/W C signal is connected to U50-1, and upon completion of WRITE, a pulse of about 2 sec is output to U49-12, causing PEN readto start.

CIRCUIT DESCRIPTION

(4) Cursor signal generator circuit and −DELAY ADDRESS (control unit)


+5V
1μs CLK
SWP
U33
U23
DOWN CARRY
UP U44
BORROW
L R
UP CARRY
U45
DOWN BORROW
U36
Sweep counter
C27 180P
R26 82KF
FLICKER signal
+5V
COMPARATOR
P0 P1 P2 P3 P4 P5 P6 P7
U24
P=Q
Q0 Q1 Q2 Q3 Q4 Q5 Q6 Q7
U23
A0 A1 A2
A<B
A>B U35
A=B
B0 B1 B2
A=B OUT
C101 390P
U37
CLR
U38
ZBC
CURSOR signal (To sweep unit)
To UPPER detection circuit (address 2000 detection)
To −DELAY COUNTER
To LOWER detection circuit (address 2 detection)
RA3 4.7K
U30
UP
Cursor CLOCK
DOWN
U14
U15
U16
PVC
Cursor address counter

When the cursor switch is pressed once to set the cursor address, the cursor address counter U14 to 16 counts 1. when the cursor switch is held pressed, the cursor clock oscillator circuit operates to perform a continuous count. The left switch functions as DOWN COUNT and the right switch functions as UP COUNT. The data of the cursor address counter becomes TRIG ADDRESS of −DELAY COUNTER. The cursor signal consists of the SWP signal which is sent from the sweep unit and the 1 uS read clock and input to the sweep counter. The sweep counter, consisting of U44, 45, and 36, and the cursor address counter are compared with each other. When they agree with other, a 1 μS pulse is emitted from U35-6. The width of this pulse is expanded by IC U46, and resulting signal ZBC which is provided with the FLICKER signal is output from C37-8.

CIRCUIT DESCRIPTION

2. Description of Adjusters and Terminals

2-1. Description of Adjusters and Terminals on Front Panel

Verticals axis

CH1 or Y adjusters and terminals

- INPUT: CH1 or Y axis input terminal
- AC-GND-DC: CH1 or Y axis input selector
- VOLTS/DIV: CH1 or Y axis input attenuator
- VARIABLE: CH1 or Y axis fine adjustment attenuator
- PULL X5 GAIN: CH1 or Y axis input sensitivity multiplier
- ⬍POSITION: [oscillo mode] CH1 vertical position adjuster or Y axis position adjuster
  [memory mode] CH1 DC OFFSET adjuster
- ⬍MEMORY POSITION: Memory waveform vertical position adjuster

CH2 or X adjuster and terminals

- INPUT: CH2 or X axis input terminal
- AC-GND-DC: CH2 or X axis input selector
- VOLTS/DIV: CH2 or X axis input attenuator
- VARIABLE: CH2 or X axis fine adjustment attenuator
- PULL X5 GAIN: CH2 or X axis input sensitivity multiplier
- ⬍POSITION: [oscillo mode] CH2 vertical position adjuster or X axis position adjuster
  [memory mode] CH2 DC OFFSET adjuster
- ⬍MEMORY POSITION: Memory waveform vertical position adjuster
- CH2 INV: CH2 or X axis polarity inverter
- MODE: Operating mode selector
  (CH1, CH2, DUAL, ADD, X-Y)
- ALT, CHOP: Display method selector

Power supply and CRT adjusters and terminals

- POWER: Power switch
- SCALE ILLUM: Scale illumination adjuster
- ⊥ (GND): Ground terminal
- CAL 0.5 V_{p-p} 1 KHz: Calibration voltage output terminal
- TRACE ROTATION: Trace tilt adjuster
- FOCUS: Focus adjuster
- INTENSITY: Brightness adjuster
- ASTIG: Astigmatism adjuster

Horizontal axis and trigger adjusters and terminals

- ◀▶POSITION: Horizontal direction position adjuster
- PULL X10 MAG: Time axis multiplier
- SWEEP TIME/DIV: Oscillo scope sweep time selector
- VARIABLE: Oscillo scope sweep time fine adjuster
- TRIGGERING MODE: Trigger mode selector
  (AUTO, NORM)
- SOURCE: Trigger signal selector
  (CH1, CH2, EXT, LINE)
- COUPLING: Trigger signal input coupling selector
  (AC, HF_{REJ}, DC)
- LEVEL: Trigger signal level adjuster
- PULL SLOPE: Trigger signal polarity selector
- EXT TRIG: External sync signal input terminal

Memory operation adjusters and terminals

- DISPLAY MODE Display type and memory write operation selector switch
- OSCILLO
  Oscilloscope operates as dual trace oscilloscope.
- REFRESH-NORM
  Memory write is started by the trigger signal or WRITE/PEN START. When 2048 words have been written, the write operation stops and the system goes into standby in a read status until the next trigger signal or manual start is input.
- REFRESH-DELAY
  The basic operation of REFRESH DELAY is the same as that of REFRESH-NORM except for the following.
  The data after the cursor point is written in the 2048 word memory on another channel by the sampling clock of that channel. When write operation for both channels is completed, the system goes into standby in a read status until the next trigger signal or manual start is input. When the MODE is DUAL, the same operation as REFRESH-NORM takes place. In the case of ADD, data after the cursor point is written to the CH1 side by SAMPLING CLOCK A.
- PRE TRIG-NORM
  Memory write is performed by WRITE/PEN START. The point set by the CURSOR switch becomes the trigger address of the memory. When the trigger signal ia in pur NS QEIRW OPWERION OD (2kw-cursor set w) completed, the system goes into standby in a read status until the start button is pressed again. However, PULL DISPLAY TIME is OFF. Using this mode, the waveform prior to the trigger signal can be observed.
  When the MODE is DUAL, CH1 performs the above operation. When write to CH1 is completed, write to CH2 is also completed.
- PRE TRIG-DELAY
  At the channel specified by MODE, the same operation as PRE TRIG-NORM takes place, and 2048 words of data after the cursor point are written to another channel by the sampling clock of that channel. Upon completion of

write operation to both channels, the system goes into standby in a read status until the start button is pressed agin. However, PULL DISPLAY TIME is OFF.

When the MODE is DUAL, PRE TRIG-NORM operation takes place on the CH1 side, and data after the CH1 cursor point (CH1 trigger point) starts to be written in the memory on the CH2 side. When 2048 words have been written, write operation stops.

• PEN/SCOPE:	SCOPE MODE, PEN MODE selector switch
• FREE RUN:	Memory write, PEN OUT read repeat switch
• WRITE/PEN START:	Memory write manual start and pen start button
• CURSOR: (DELAY or PRE TRIG POSITION)	Minus delay point and sub-channel write point setting switch
• FREEZE:	Write operation stop switch
• SAMPLING CLOCK A, B:	Sampling frequency selector
• PULL DISPLAY TIME:	Display time setting switch
• PEN SPEED:	PEN SPEED selector
• 8DIV/4DIV:	8DIV, 4DIV selector switch

LEDs

• LED (red) POWER:	Power indicator
• LED (green) TRIG'D:	Trigger indicator
• LED (green) READ:	Read status indicator
• LED (red) WRITE A, B:	Write status indicator
• LED (green) CURSOR:	Cursor advance direction indicator
• LED (green) FREEZE:	Write operation stop indicator
• LED (green) GP-IB:	SRQ, TALK, LISTEN, REN indicator

2-2. Description of Adjusters and Terminals on Real Panel

• MEMORY OUT A, B:	Digital to analog conversion signal output terminal
• FOR PEN A, B:	Pen recorder signal output terminal
• READ GATE OUT:	Memory final address output terminal
• READ GATE OUT FOR PEN:	Pen down signal output terminal
• EXT CLOCK:	read-only external clock input terminal
• SWEEP GATE 220Ω:	Sweep gate output terminal
• Z AXIS 10KΩ 50V:	External brightness modulation input terminal
• CH1 OUT mV/DIV 50Ω:	CH1 vertial signal output terminal
• ADDRESS:	GP-IB address setting switch
• GP-IB connector:	GP-IB connector
• Power supply connector:	AC power suply input connector
• FUSE:	Fuse holder
• Voltage selector:	AC voltage selector
• GND:	Ground terminal
• Fan:	Cooling fan inside cabinet

ADJUSTMENT

1. Adjustment Preparations

1-1. Presettings

Knob	Set position
POWER	ON
FOCUS	Optimum adjustment point
ASTIG	Optimum adjustment point
INTENSITY	3 o'clock position after adjustment
MODE	CH1 (▄) depressed; other mode switches (█) released
MEMORY POSITION	Mechanical center (both CH1 and CH2)
POSITION	Mechanical center (both CH1 and CH1)
VOLTS/DIV	5mV (both CH1 and CH2)
VARIABLE PULL × 5 GAIN	CAL PUSH (both CH1 and CH2)
AC-GND-DC	DC (both CH1 and CH2)
POSITION PULL × 10 MAG	Mechanical center PUSH
SWEEP TIME/DIV	.1mS
VARIABLE	CAL
TRIGGERING MODE	AUTO
TRIGGERING SOURCE	CH1
TRIGGERING COUPLING	AC
TRIGGERING LEVEL	Mechanical center and PUSH
DISPLAY MODE	OSCILLO
8 BITS FULL SCALE	8 DIV
DISPLAY MODE NORM, DELAY	NORM (▄)
PEN SCOPE	SCOPE (█)
FREE RUN	OFF (█)
SAMPLING CLOCK	5μS (both A abd B)
PULL DISPLAY TIME	Fully. counterclockwise and PULL
PEN SPEED	10mS
ADDRESS	ϕ7

1-2. Instruments Used

The instruments used must be those shown below or those with at least equivalent performance.

Type of instrument	Model name	Maker	Remarks
Multimeter	DL-720	Trio	
High voltage probe		HIOKI	Modified
Pulse generator	PG-506	Tektronix	
Timer marker	TG-501	Tektronix	
Sine wave generator	SG-503	Tektronix	
Sine wave generator	651B	HP	
Q-meter		Trio	
10dB ATT			
50 Ω terminator			
BNC T-3 JACKS			
Square wave generator	211B	HP	
Wattmeter			
Insulation tester			
Dielectric strength tester			
Oscilloscope	CS-2110	Trio	
DC standard			
Frequency counter			

1-3. Checking Each Voltage

Voltage	Range
+5V	+4.75 ~ 5.25V
+10V	+9.7 ~ 10.3V
+20V	+19.4 ~ 20.6V
+140V	+135.8 ~ 144.2V

1-4. −10V Adjustment

Adjust VR1 (power supply unit) so that pin 4 of P21 of the power supply unit becomes −10 V.

Rating: −9.7V to −10.3V

1-5. High Voltage Adjustment

Adjust VR2 (power supply unit) so that pin 3 of P40 of the power supply unit becomes 1.5 kV±0.01 kV

Note: Use a high voltage probe.

When measuring waveforms using MEMORY OUT and SWEEP GAIN, connect the oscilloscope as shown below.

MS-1660	External Oscilloscope
MEMORY OUT ———	CH1, CH2
SWEEP GATE ———	EXT TRIG

Set position of external oscilloscope
VOLTS/DIV : 0.2V/div
SWEEP TIM/DIV : 0.2ms/div
TRIG' SOUCE : EXT

ADJUSTMENT

2. CRT Adjustment

2-1. INTENSITY Adjustment

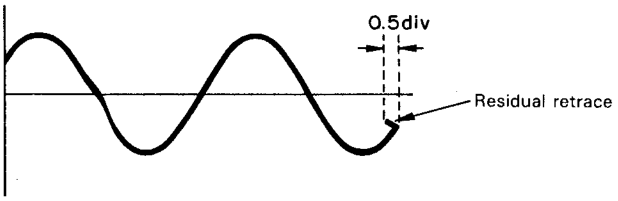
TRIG MODE: X-Y   AC-GND-DC: GND

Adjust VR3 (power supply unit) so that the trace goes out when the INTENSITY knob is at the 9:30 position.
Turning the knob clockwise should increase the brightness of the trace, and turning it counterclockwise should decrease that brightness.

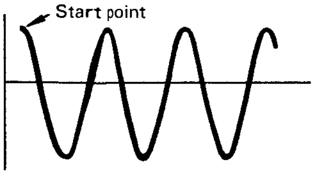
2-2. Blanking Adjustment

MODE: CH1, AC-GND-DC: AC
SWEEP TIME/DIV: 2µS (PULL x10 MAG)
INTENSITY: Fully clockwise   VOLTS/DIV: 5 mV

1. Input a 1 MHz sine wave to the CH1 INPUT and set the amplitude to 3 divisions.
2. Adjust TC1 (power supply unit) so that the brightness of the trace at the start of the waveform has minimal ununiformity and also the return of the trace (retrace) at the end of the waveform is as small as possible. Note that according to this adjustment the size of the residual retrace at the end of the sweep and also the brightness of the trace at the start of the sweep will change.



Perform adjustment so that the residual retrace is within 0.5 div in the horizontal direction.



The trace at the start point must disappear at INTEN min.

INTEN: 10:30 position;
SWEEP TIME/DIV 0.5 µS

2-3. Adjusting Trace Centering

1. Place a shorting bar across the test pins of the vertical amplifier unit.
2. Adjust VR20 (vertical amplifier unit) so that the trace comes to the horizontal center of the screen.

2-4. Adjusting 55 V

AC-GND-DC: GND

1. Short-circuit R197 and 198 of the vertical amplifier unit.
2. Adjust VR19 (vertical amplifier unit) so that the +Y (or −y) voltage becomes 55 V ±0.5 V. If the center of the trace shifts during this adjustment, repeat adjustment from procedure 2-3.

3. Adjusting Vertical Amplifier

3-1. Adjusting CH1X5 DC BAL

AC-GND-DC: GND

Adjust VR1 (vertical head amplifier unit) so that the trace does not move up and down in either the CH1 PULL X5 GAIN or NORM mode.

3-2. Adjusting CH1 DC BAL

AC-GND-DC: GND

Adjust VR1 (vertical amplifier unit) so that the trace does not move up or down when the VARIABLE knob is rotated at a setting of VOLTS/DIV 5 mV.

3-3. Adjusting CH1 POSITION

Adjust VR3 (vertical amplifier unit) so that when the CH1 POSITION knob is at its mechanical center, the trace comes to the center of the screen.

3-4. Adjust CH1 GAIN

MODE: CH1   VOLTS/DIV: 5 mV

Apply a 20 mVp-p 1 kHz square wave to CH1 INPUT, and adjust VR4 (vertical amplifier unit) so that the amplitude of the waveform becomes 4 divisions.

3-5. Adjusting CH2 DC BAL

Adjust CH2 DC BAL (MODE: CH2) in the same way as for CH1 using VR2 (vertical head amplifier unit).

3-6. Adjusting CH2 DC BAL

Adjust CH2 DC BAL (MODE: CH2) in the same way as for CH1 using VR9 (vertical amplifier unit).

3-7. Adjusting CH2 INV DC BAL

Adjust CH2 INV DC BAL (MODE: CH2 INV) using VR8 (vertical amplifier unit).

3-8. Adjusting CH2 POSITION

Adjust CH2 POSITION (MODE: CH2) in the same way as for CH1 using VR12 (vertical amplifier unit).

3-9. Adjusting CH2 INV POSITION

MODE: CH2   AC-GND-DC: GND

1. Move CH2 POSITION so that the trace comes to the center of the screen.
2. Adjust VR11 (vertical amplifier unit) so that when CH2 INV is depressed, the trace comes to the center of the screen.

ADJUSTMENT

3-10. Adjusting CH2 GAIN

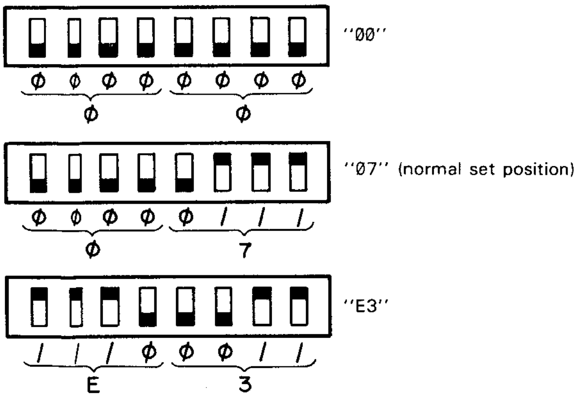
MODE: CH2 VOLTS/DIV: 5 mV

Apply a 20 mVp-p 1 kHz square wave to CH2 INPUT, and adjust VR14 (vertical amplifier) so that the amplitude of the waveform becomes 4 divisions. The amplitude must not change when CH2 INV is depressed.

4. Setting memory board address switches

Be careful of the following points when operating the address switches at the back of the oscilloscope in order to adjust the memory board unit.

1) When an address switch is in the top position, it represents "1". When the switch is in the bottom position, it represents "0". In the adjustment procedure, an address is represented in hexadecimal notation. When changing an address, first turn off the oscilloscope and then operate the switches.
   Upon completion of adjustment, set the switches to "07".



Because adjustment is the same for both CH1 and CH2, the description is based on CH1; the VR numbers and test pin numbers for CH2 are given in parenthesis.
SAMPLING CLOCK A, B: 0.1 mS/WORD TRIGGERING SOURCE: LINE Use pins 1 and 2 of input terminal P1 (P2) as GND, and pin 3 as input.

4-1. Adjusting DC Offset (1)

Set VR11 (VR18) to 0Ω (turn fully counterclockwise).
Set input P1 (P2) to 0 V and adjust VR2 (VR6) so that the voltage of TP2 (TP5) becomes −250 mV ± 1.5 mV.

4-2. Adjusting Input GAIN

AC-GND-DC: GND

1. Apply −800 mVDC to input P1 (P2), and adjust VR1 (VR5) so that the voltage at TP2 (TP5) becomes −475 mV ± 2.5 mV.
2. Apply +800 mVDC to input P1 (P2) and verify that the voltage at TP2 (TP5) is −25 mV ± 1 mV. If it is not, repeat steps 1 and 2.

* Set GAIN to −450 mV. Next alternately input −800 mV and +800mV to P1 (P2) and adjust so that −475.0 mV and 25.0 mV are obtained at TP2 (TP5).
It is also possible to perform adjustment so that the lowest digits become the same.

4-3. Adjusting A/D V_{ref}

Adjust VR3 (VR7) so that the voltage at TP3 (TP6) becomes −500 mV ± 0.5 mV.

4-4. Adjusting D/A GAIN

1. The WRITE LED must be out when TRIG is not applied (the TRIG LEVEL knob is set to the maximum + or − position).
2. Turn off the oscilloscope, then set the ADDRESS switch to "E3" and once again turn on the oscilloscope. Adjust VR13 (VR20) so that the voltage at TP7 (TP9) becomes +1.776 V ± 2 mV. (Before this adjustment, remove the DC bias jumper J1 (J2).)
3. Connect J1 (J2) and adjust VR14 (VR21) so that the voltage at TP7 (TP9) becomes +888 mV ± 4 mV. Upon completion of adjustment, reset the address to "07".

4-5. Re-adjusting D/A Gain (1)

Apply +800 mVDC to input P1 (P2), and adjust VR2 (VR6) so that the voltage at TP7 (TP9) becomes −800mV± 8 mV.

4-6. Re-adjusting D/A Gain (2)

Apply −800 mVDC to input P2 (P2), and adjust VR3 (VR7) so that the voltage at TP7 (TP9) becomes +800 mV± 8 mV.

4-7. Re-adjusting DC offset

Set input P1 (P2) to 0 V, and re-adjust VR14 (VR21) so that the voltage at TP7 (TP9) becomes 0 V ± 2 mV.

4-8. PEN OUT Adjustment

1. Set input P1 (P2) to 0 V. Using VR14 (VR21), adjust the voltage at TP7 (TP9) to 0 V ± 1 mV. Next, adjust VR12 (VR19) so that the voltage at TP8 (TP10) becomes 0 V ± 1 mV.
2. Set the PEN/SCOPE switch to the PEN position(▃) and press the WRITE/PEN START switch. After about 2 seconds, data will start to be output. At this time, adjust VR14 (VR21) so that the voltage at the PEN OUT A(B)

terminal (rear panel) becomes 0 V ± 2 mV. Upon completion of adjustment, set the PEN/SCOPE switch to the SCOPE position (■).

3. Apply +800 mVDC to input P1 (P2), and depress the PEN/MONI switch (▄). Press the WRITE/PEN START switch. After about 2 seconds, data output will start. At this time, adjust VR8 (VR15) so that the voltage at the PEN OUT A(B) terminal becomes +1,000 V ± 10 mV. After adjustment, re-press the PEN/MONI switch (■).
4. Apply −800 mVDC to input P1 (P2), and depress the PEN/MONI switch (▄). Press the WRITE/PEN START switch. After about 2 seconds, data output will start. At this time, verify that the voltage at the PEN OUT A(B) terminal is −1,000 V ± 10 mV. After adjustment, re-press the PEN/MONI switch (■).

   When adjusting the PEN OUT output, set PEN SPEED to 50 mS/word. Next, press the WRITE/PEN START switch. About 2 seconds later, data will be output for about 100 seconds. To repeat the PEN OUT operation (repetition of 2 seconds waiting time and 100 seconds data output time), depress the FREE RUN switch (▄).

4-9. Adjusting MEMORY OUT (1)

Set input P1 (P2) to 0 V, and adjust VR14 (VR21) so that the voltage at the MEMORY OUT terminal becomes 0 V ± 2 mV.

4-10. Adjusting MEMORY OUT (2)

1. Apply +800 mVDC to input P1 (P2), and adjust VR10 (VR17) so that the voltage at the MEMORY OUT A(B) terminal becomes +800 mV ± 8 mV.
2. Apply −800 mVDC to input P1 (P2), and verify that the voltage at the MEMORY OUT A(B) terminal is −800 mV ±8 mV.

   Note: Output from MEMORY OUT for +800 mVDC input: α

   Output from MEMORY OUT for −800 mVDC input: β

   $\alpha + \beta$ must be 1.6 V ± 8 mV.

4-11. Adjusting 8-BIT FULL SCALE

1. Set the 8-BIT FULL SCALE switch to 4 DIV (▄), apply +800 mVDC to input P1 (P2), and adjust VR9 (VR11) so that the voltage at the MEMORY OUT terminal becomes +400 mV ± 4 mV.
2. Apply −800 mVDC to P1 (P2), and verify that the voltage at the MEMORY OUT terminal is −400 mV ± mV.

   Output from MEMORY OUT for +800 mVDC input: α

   Output from MEMORY OUT for −800 mVDC input: β

   $\alpha + \beta$ must be 1600 mV ± 16 mV.

4-12. Adjusting AD Signal and Trigger Signal

VOLTS/DIV: 5 mV MODE: CH1 AC-GND-DC: GND
DISPLAY MODE: OSCILLO

1. Connect connectors P1 and P2. Next, using the CH1 POSITION knob, align the trace with the horizontal center of the screen.
2. Set the DISPLAY MODE to REFRESH, and adjust VR5 (vertical amplifier) so that pins 1 and 3 of P12 become the same potential.
3. Adjust VR7 (vertical amplifier) so that the volage at pin 2 of P17 becomes 0 V ± 2 mV. Re-check step 2, and if the adjustment has changed, repeat steps 2 and 3.
4. Set AC-GND-DC to DC, and CH1 VOLTS/DIV to 5 mV. Next, apply +20 mVDC to CH1 INPUT, and adjust VR6 (vertical amplifier) so that the output at the MEMORY OUT A terminal (rear panel) is 800 mV ± 8 mV.
5. Apply −20 mVDC to CH1 INPUT, and verify that the voltage at the MEMORY OUT erminal is −800 mV ± 8 mV.

Note: After inputting a signal or changing the polarity, wait for about 10 seconds before performing measurement or adjustment.
For steps 4 and 5, set SOURCE to LINE.

4-13. Adjusting AD Signal and Trigger Signal

Perform adjustment in a similar way to that of CH1 .

P12 → P13
VR5 → VR15
VR7 → VR17
VR6 → VR16
VR17 → P18
MEMORY OUT A → MEMORY OUT B

4-14. Adjusting MEMORY POSITION

MODE: CH1 AC-GND-DC: GND
DISPLAY MODE: OSCILLO

1. Using CH1 ⇕ POSITION, align the trace with the center of the screen. Next, set DISPLAY MODE to REFRESH, and rotate the MEMORY POSITION knob to its mechanical center. SOURCE: LINE
2. Using VR21 (vertical unit), align the trace with the center of the screen.

ADJUSTMENT

4-15. Adjusting MEMORY CH1 GAIN

DISPLAY MODE: REFRESH-NOM AC-GND-DC: DC
MODE: CH1 VOLTS/DIV: 5 mV SOURCE: LINE

1. Apply +20 mVDC to CH1 INPUT, and adjust VR22 (vertical unit) so that the trace comes to the +4 division.
2. Input −20 mVDC to CH1 INPUT and verify that the trace comes to the −4 division.

Note: After inputting a signal or reversing the polarity of the input signal, wait for about 10 seconds before performing measurement or adjustment.
If MEMORY CH1 POSITION shifts as the result of this adjustment, repeat adjustment from 4-14.

4-16. Adjusting MEMORY CH2 POSITION

Perform adjustment in a similar way to that for CH1 (MODE: CH2).

VR21 → VR23

4-17. Adjusting MEMORY CH2 GAIN

Perform adjustment in a similar way to that for CH1 (MODE: CH2).

VR22 → VR24

4-18. Adjusting ADD

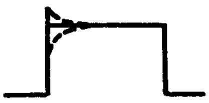
VOLTS/DIV: 5 mV MODE: CH2
AC-GND-DC: GND DISPLAY MODE: OSCILLO

1. Connect connectors P1 and P2, and adjust the CH2 ⬍ POSITION knob so that the voltage at pin 6 of U7 becomes 0 V ± 1 mV.
2. Set the MODE to ADD, and adjust the CH1 ⬍ POSITION knob so that the voltage at pin 6 of U7 becomes 0 V ± 1 mV. Next, apply +10 mV DC to CH1 INPUT and CH2 INPUT, and adjusts VR4 so that the voltage at pin 6 of U7 becomes 800 mV ± 4 mV.
3. Apply −10 mVDC to CH1 INPUT and CH2 INPUT, and verify that the voltage at pin 6 of U7 is −800 mV ± 4 mV.

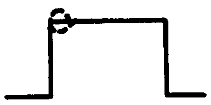
4-19. Adjusting CH1 Overshoot

AC-GND-DC: DC VOLTS/DIV: 5 mV
SWEEP TIME/DIV: 0.2 μS

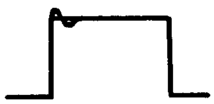
1. Apply a 1 MHz square wave to CH1 INPUT, and adjust the amplitude of the waveform to 6 divisions.
2. Using TC1 (vertical amplifier unit), make the middle and low frequency ccomponents of the waveform flat.



3. Set TC2 (vertical amplifier unit) to its mechanical center.
4. Using TC3 (vertical amplifier unit), make the middle frequency component flat.



5. Using TC6 (vertical amplifier unit) and VR25 (vertical amplifier unit), adjust the high frequency component.



6. Repeat stesps 4 and 5 until the waveform becomes square.

4-20. CH2 Wave-shaping and Overshoot Adjustment

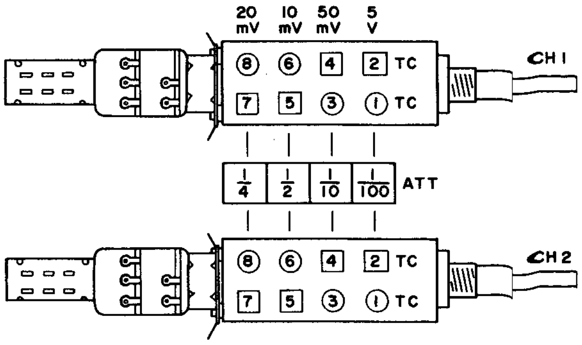
Perform adjustment in a similar way to that of CH1.

TC3 → TC5
TC6 → TC4
VR25 → VR26

Perform steps 3, 4, and 5 of 4-19 in accordance with the above conditions. If adjustment is impossible, finely adjust TC2.

4-21. CH1 and CH2 Wave-shaping and Input Capacity Adjustment

1. Input a 1 kHz square wave and set the amplitude to 6 divisions.
2. Make the waveform in the 10 mV range flat.
3. Next, perform waveform shaping in the 20 mV range, adjust the 10 mV input capacity, adjust the 20 mV input capacity, perform wave-shaping and input capacity adjustment in the 50 mV range, and finally perform wave-shaping and input capacity adjustment in the .5V range.



ADJUSTMENT

	☐ mark	○ mark
	Input capacity	**Wave-shaping**
5 mV reference	———	———
10 mV 1/2	TC5	TC6
20 mV 1/4	TC7	TC8
50 mV 1/10	TC4	TC3
.5 V 1/100	TC2	TC1

Adjustment sequence

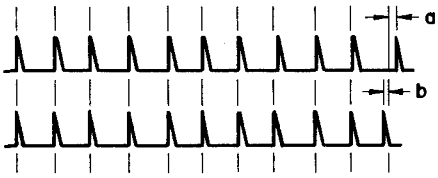
① 10 mV wave-shaping
  → ② 20 mV wave-shaping
    → ③ 10 mV input capacity
④ 20 mV input capacity
  → ⑤ 50 mV wave-shaping and input capacity
⑥ .5 V wave-shaping and input capacity

Note: .1 V wave-shaping: When overshoot is found, adjust TC5.
.2 V wave-shaping: When overshoot is found, adjust TC7.

5. Sweep Unit

5-1. SWEEP TIME Adjustment

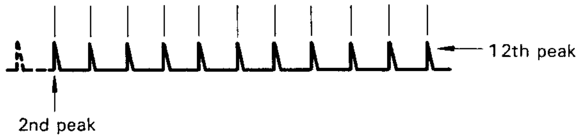
1. Set SWEEP TIME/DIV to 0.1 mS, then apply a 0.1 mS marker signal to V INPUT.
2. Adjust VR14 (sweep unit) so that when the first peak of the marker signal is aligned with the left edge of the graduated scale on the screen, the 11th peak coincides with the right edge of the scale.
3. Set SWEEP TIME/DIV to 10 mS, then apply a 10 mS marker signal to V INPUT and check whether or not the first peak of the marker coincides with the left edge of the graduated scale on the screen and the 11th peak with the right edge. If the peaks are misaligned, set SWEEP TIME/DIV to 0.1 mS and 10 mS, respectively, and adjust VR14 (sweep unit) so that the error is the same in both cases.



Note: Perform adjustment so that a = b.

5-2. SWEEP LENGTH Adjustment

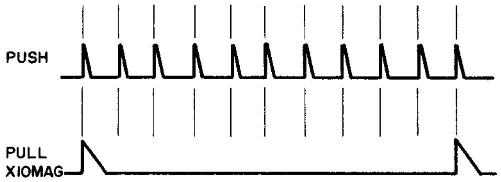
1. Apply a 0.1 mS marker signal to CH1 INPUT.
2. Verify that when the first peak is aligned with the left edge of the graduated scale on the screen, the 11th peak coincides with the right edge of the scale. Using the ◄ ► POSITION knob, shift the waveform by one peak to the left and adjust VR9 (sweep unit) so that the 12th peak coincides with the right edge of the scale.



5-3. Adjusting × 10 MAG GAIN

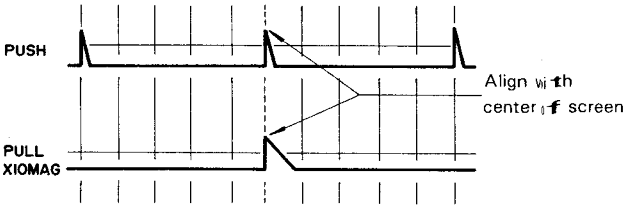
MODE: CH1 VOLTS/DIV: 1V

1. Apply a 0.1 mS marker signal to CH1 INPUT, and align the first and 11th peaks with the scale on the screen.
2. Adjust VR19 (sweep unit) so that when the PULL × 10 MAG knob is pulled, the interval between the peaks of the marker signal becomes 10 divisions.



5-4. Adjusting × 10 MAG Center

1. Apply a 0.5 mS marker signal to CH1 INPUT.
2. Set PULL × 10 MAG to PULL, and rotate the H POSITION knob until the center peak comes to the center of the screen.
3. In this condition, adjust VR20 (sweep unit) so that when the PULL × 10 MAG knob is pushed, the center peak comes to the center of the screen.
4. Repetively change the PULL × 10 MAG knob between PULL and PUSH several times and verify that the peak of the marker signal at the center of the screen does not move.

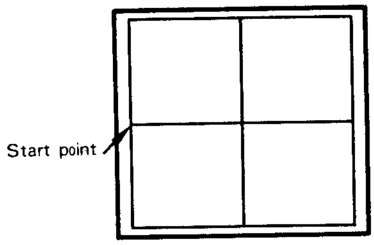


ADJUSTMENT

5-5. Adjusting SWEEP POSITION

AC-GND-DC: GND

1. Rotate the H POSITION knob to its mechanical center.
2. Adjust VR16 (sweep unit) so that the start point of the trace comes to the left edge of the scale.



5-6. Adjusting SWEEP TIME 5 μS

1. Set SWEEP TIME/DIV to 5 μS, then apply a 5 μS marker signal to CH1 INPUT.
2. Adjust TC1 (sweep unit) so that the first peak of the marker signal on the screen coincides with the left edge of the scale on the screen, and the 11th peak with the right edge of the scale.

5-7. Adjusting MEMORY SWEEP TIME

DISPLAY MODE: REFRESH MODE: CH1
SAMPLING CLOCK A: 1 μS/word

1. Apply a 0.2 mS marker signal to CH1 INPUT.
2. Adjust VR7 (sweep unit) so that the first peak of the marker signal coincides with the left edge of the scale on the screen, and the 11th peak with the right edge of the scale.

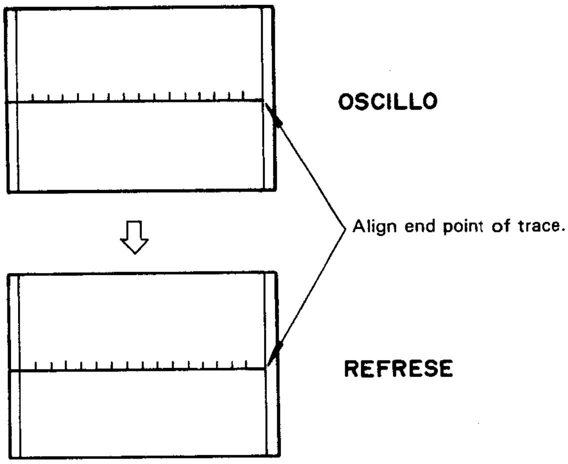
5-8. Aligning Start Point of MEMORY OSCILLO SWEEP

AC-GND-DC: GND SWEEP TIME/DIV: 0.1 mS
SOURCE: LINE DISPLAY MODE: OSCILLO
SAMPLING CLOCK A: 0.1 mS/word INTEN: MAX

1. Align the start point of the trace with the left edge of the scale on the screen.
2. Set DISPLAY MODE to REFRESH, and adjust VR6 (sweep unit) so that the start point of the trace coincides with the left edge of the scale on the screen.

5-9. Adjusting MEMORY SWEEP LENGTH

1. Set DISPLAY MODE to OSCILLO, and align the right edge of the trace with the right edge of the scale on the screen.
2. Set DISPLAY MODE to REFRESH, and adjust VR8 (sweep unit) so that the end point of the trace coincides with the right edge of the scale on the screen.



5-10. Adjusting × GAIN

MODE: X-Y AC-GND-DC: AC VOLTS/DIV: 5 mV

Apply a 20 mVp-p square wave signal to CH2 INPUT, and adjust VR13 (sweep unit) so that the horizontal amplitude becomes 4 divisions.

Note: make the horizontal amplitude 4 divisions symmetrical about the center of the screen.

5-11. Adjusting × POSITION

MODE: CH2 AC-GND-DC: GND

Adjust the CH2 POSITION knob so that the trace comes to the center of the screen. In this condition, set MODE to X-Y and adjust VR12 (sweep unit) so that the beam spot comes to the center of the screen.
Move the CH2 POSITION knob to its mechanical center and verify that the error between the spot and the center of the screen is within 0.5 divisions. Next, rotate the CH2 POSITION knob fully clockwise and counterclockwise, and verify that the spot moves at least 5 divisions from the center to the right and left, respectively.

5-12. Adjusting MEMORY × POSITION Center

MODE: CH2 SOURCE: LINE
SAMPLING CLOCK: 0.1 mS/word

1. Using the CH2 ⬍ POSITION knob, move the trace to the center of the screen. Next, set DISPLAY MODE to REFRESH, and using the CH2 MEMORY POSITION knob bring the trace to the center of the screen.
2. Set MODE to X-Y and adjust VR18 (sweep unit) so that the beam spot comes to the center of the screen.

5-13. Adjusting MEMORY × GAIN

MODE: CH2 SOURCE: LINE DISPLAY MODE: OSCILLO

1. Using the CH2 ⬍ POSITION knob, align the trace with

the center of the screen. Next, set DISPLAY MODE to REFRESH, then using the CH2 ⬍ MEMORY POSITION knob move the trace to the center of the screen.

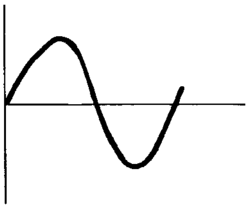
2. Change MODE to X-Y and set AC-GND-DC to DC. Next, apply +20V mVDC to CH2 INPUT and adjust VR17 (sweep unit) so that the horizontal axis is +4 divisions with respect to the center of the screen.
3. Apply −20 mVDC to CH2 INPUT and verify that the beam spot is −4 divisions from the center. If it is not, repeat the above adjustments.

Note: After changing the input, allow at least 10 seconds before performing adjustment.

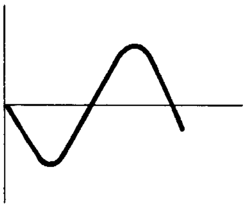
5-14. Adjusting TRIG SLOPE

AC-GND-DC: AC SWEEP TIME/DIV: 0.2 mS

1. Apply a 1 kHz sine wave to CH1 INPUT and set the amplitude to 6 divisions.
2. Adjust the TRIG LEVEL and CH1 ⬍ POSITION knobs so that the amplitude of the waveform is symmetrical about the horizontal scale passing through the center of the screen.
3. Adjust VR3 (sweep unit) so that when TRIG SLOPE is set to −(PULL) and +(PUSH), respectively, the start points are the same.



SLOPE (+)
PUSH



SLOPE (−)
PULL

5-15. Adjusting TRIG Level Center

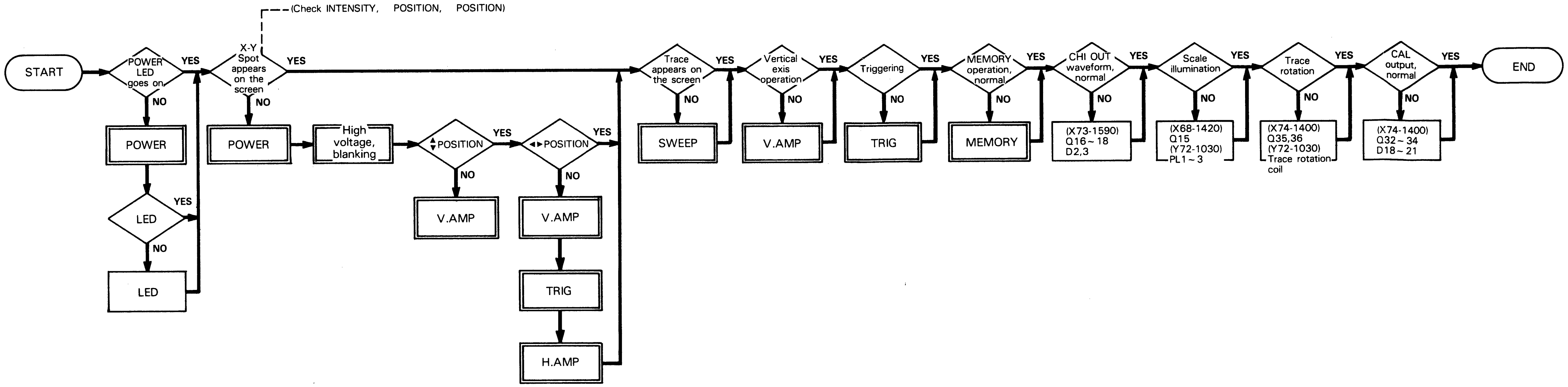
AC-GND-DC: AC

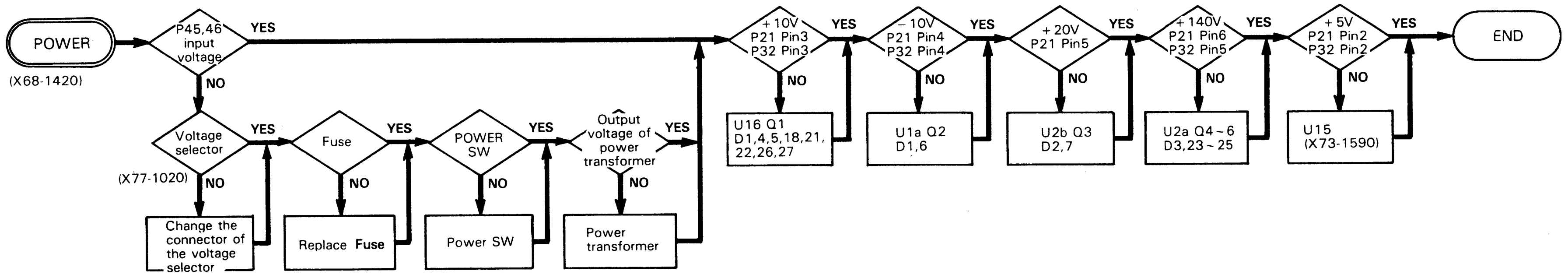
1. Move the TRIG LEVEL knob to its mechanical center.
2. Apply a 1 kHz sine wave to CH1 INPUT, and set the amplitude to 6 divisions.
3. Adjust the CH1 ⬍ POSITION knob so that the waveform amplitude is symmetrical about the horizontal center of the screen.
4. Adjust VR2 (sweep unit) so that the start point of the waveform coincides with the left edge of the horizontal scale passing through the center of the screen.

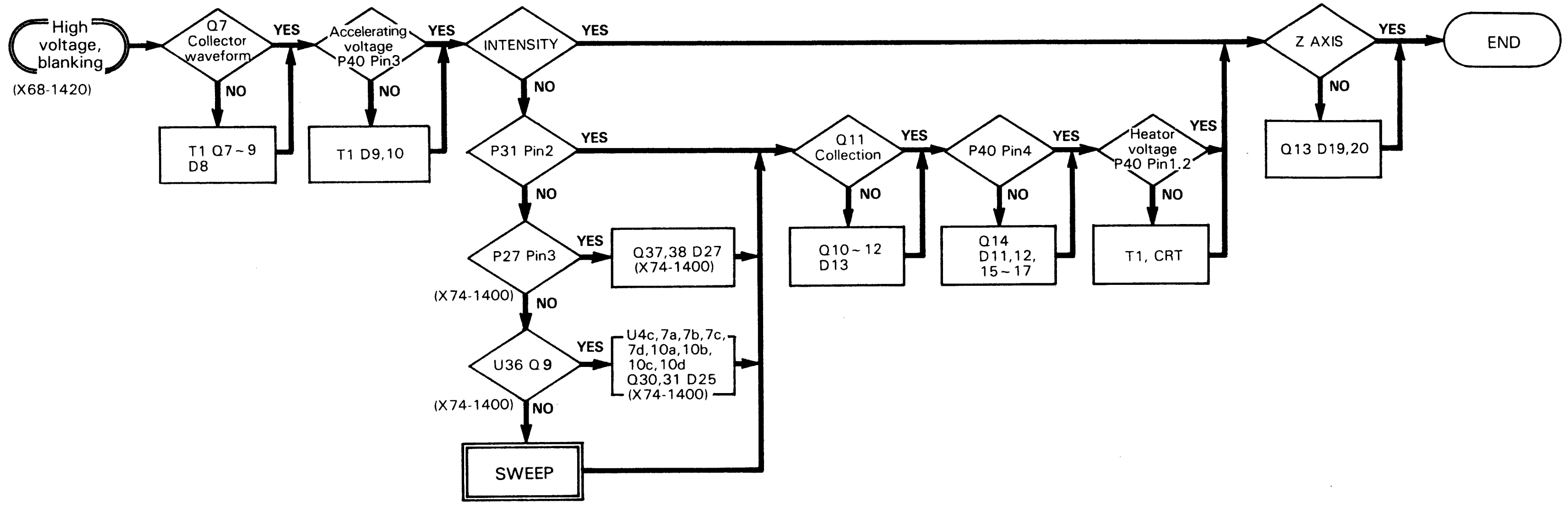
5-16. Adjusting CAL Output

1. Using a calibrated oscilloscope (0.1 V/DIV), adjust VR10 (sweep unit) so that the amplitude of the CAL output becomes 0.5 Vp-p.
2. Using a frequency counter, adjust VR11 (sweep unit) so that the CAL output frequency becomes 1 kHz.

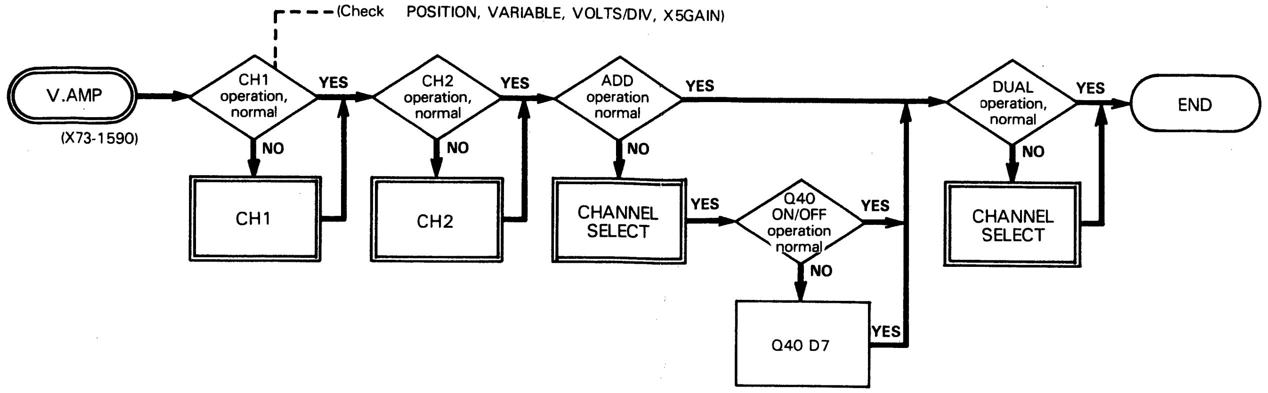
TROUBLESHOOTING

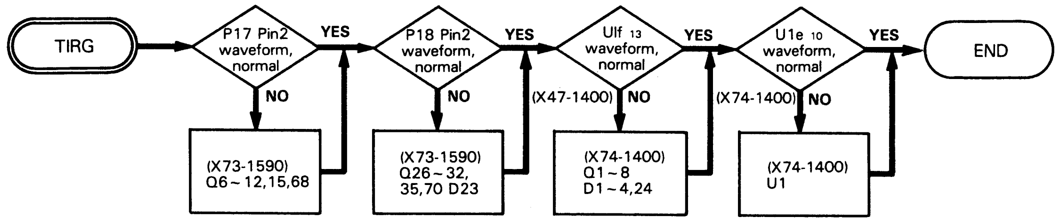

(Check INTENSITY, POSITION, POSITION)
START
POWER LED goes on
YES
NO
POWER
LED
YES
NO
LED
X-Y Spot appears on the screen
YES
NO
POWER
High voltage, blanking
▲▼POSITION
YES
NO
V.AMP
◄►POSITION
YES
NO
V.AMP
TRIG
H.AMP
Trace appears on the screen
YES
NO
SWEEP
Vertical exis operation
YES
NO
V.AMP
Triggering
YES
NO
TRIG
MEMORY operation, normal
YES
NO
MEMORY
CHI OUT waveform, normal
YES
NO
(X73-1590) Q16~18 D2,3
Scale illumination
YES
NO
(X68-1420) Q15 (Y72-1030) PL1~3
Trace rotation
YES
NO
(X74-1400) Q35,36 (Y72-1030) Trace rotation coil
CAL output, normal
YES
NO
(X74-1400) Q32~34 D18~21
END

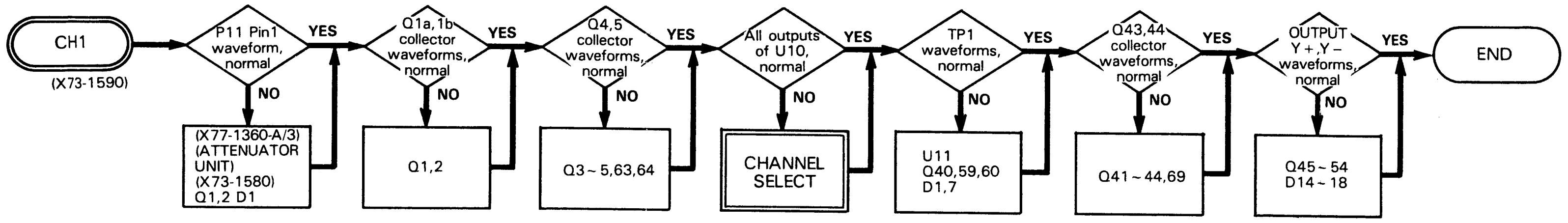

POWER
(X68-1420)
P45,46 input voltage
YES
NO
Voltage selector
(X77-1020)
YES
NO
Change the connector of the voltage selector
Fuse
YES
NO
Replace Fuse
POWER SW
YES
NO
Power SW
Output voltage of power transformer
YES
NO
Power transformer
+10V P21 Pin3 P32 Pin3
YES
NO
U16 Q1 D1,4,5,18,21, 22,26,27
−10V P21 Pin4 P32 Pin4
YES
NO
U1a Q2 D1,6
+20V P21 Pin5
YES
NO
U2b Q3 D2,7
+140V P21 Pin6 P32 Pin5
YES
NO
U2a Q4~6 D3,23~25
+5V P21 Pin2 P32 Pin2
YES
NO
U15 (X73-1590)
END

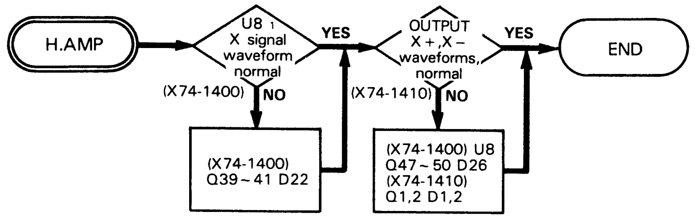

High voltage, blanking
(X68-1420)
Q7 Collector waveform
YES
NO
T1 Q7~9 D8
Accelerating voltage P40 Pin3
YES
NO
T1 D9,10
INTENSITY
YES
NO
P31 Pin2
YES
NO
P27 Pin3
(X74-1400)
YES
NO
Q37,38 D27 (X74-1400)
U36 Q9
(X74-1400)
YES
NO
U4c,7a,7b,7c, 7d,10a,10b, 10c,10d Q30,31 D25 (X74-1400)
SWEEP
Q11 Collection
YES
NO
Q10~12 D13
P40 Pin4
YES
NO
Q14 D11,12, 15~17
Heator voltage P40 Pin1,2
YES
NO
T1, CRT
Z AXIS
YES
NO
Q13 D19,20
END

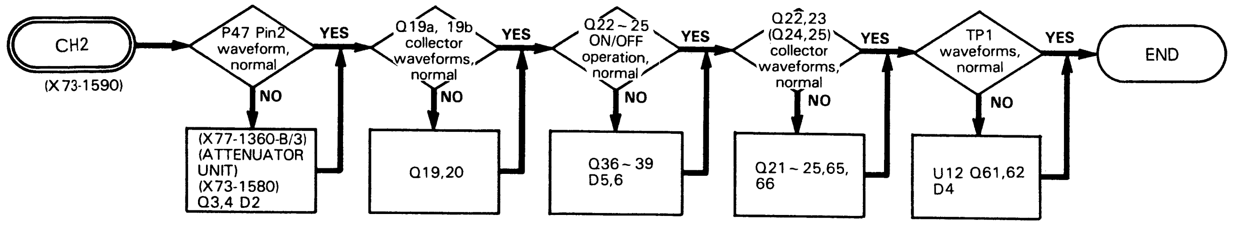
TROUBLESHOOTING

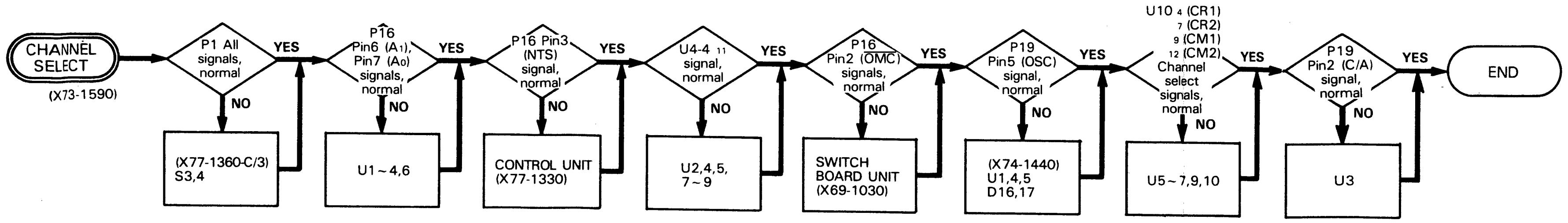

(Check POSITION, VARIABLE, VOLTS/DIV, X5GAIN)
V.AMP
(X73-1590)
CH1 operation, normal
YES
NO
CH1
CH2 operation, normal
YES
NO
CH2
ADD operation normal
YES
NO
CHANNEL SELECT
YES
Q40 ON/OFF operation normal
YES
NO
Q40 D7
YES
DUAL operation, normal
YES
NO
CHANNEL SELECT
END


TIRG
P17 Pin2 waveform, normal
YES
NO
(X73-1590) Q6 ~ 12,15,68
P18 Pin2 waveform, normal
YES
NO
(X73-1590) Q26 ~ 32, 35,70 D23
Ulf 13 waveform, normal
YES
(X47-1400)
NO
(X74-1400) Q1 ~ 8 D1 ~ 4,24
U1e 10 waveform, normal
YES
(X74-1400)
NO
(X74-1400) U1
END

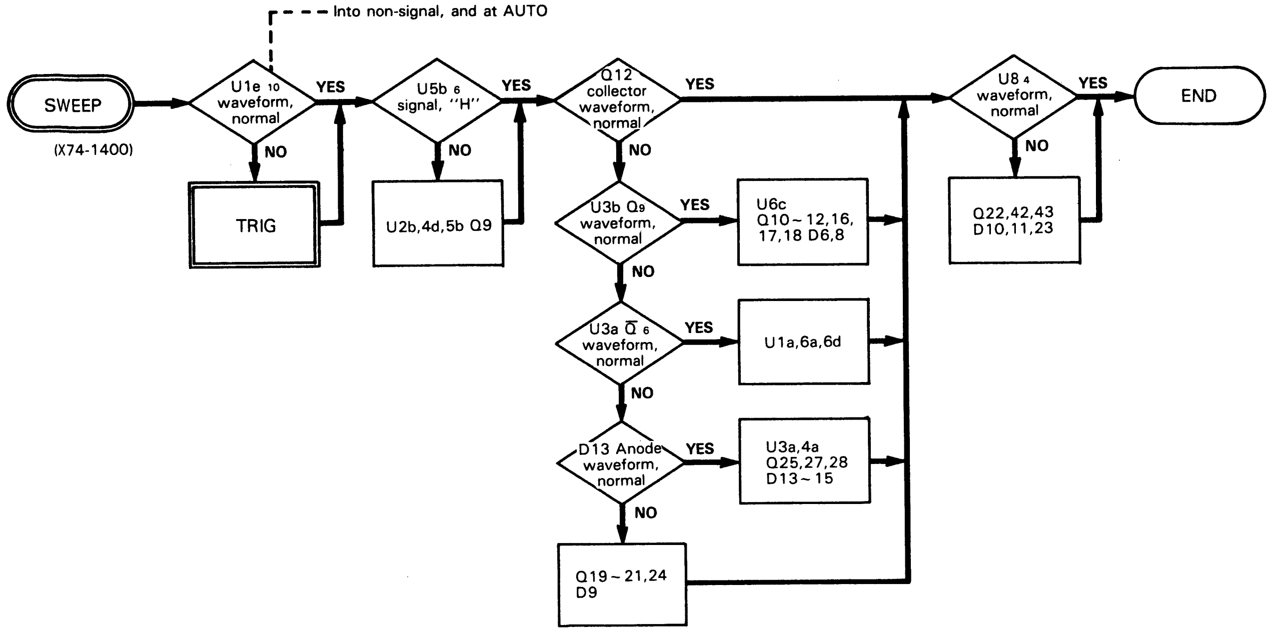

CH1
(X73-1590)
P11 Pin1 waveform, normal
YES
NO
(X77-1360-A/3) (ATTENUATOR UNIT) (X73-1580) Q1,2 D1
Q1a,1b collector waveforms, normal
YES
NO
Q1,2
Q4,5 collector waveforms, normal
YES
NO
Q3 ~ 5,63,64
All outputs of U10, normal
YES
NO
CHANNEL SELECT
TP1 waveforms, normal
YES
NO
U11 Q40,59,60 D1,7
Q43,44 collector waveforms, normal
YES
NO
Q41 ~ 44,69
OUTPUT Y + ,Y – waveforms, normal
YES
NO
Q45 ~ 54 D14 ~ 18
END

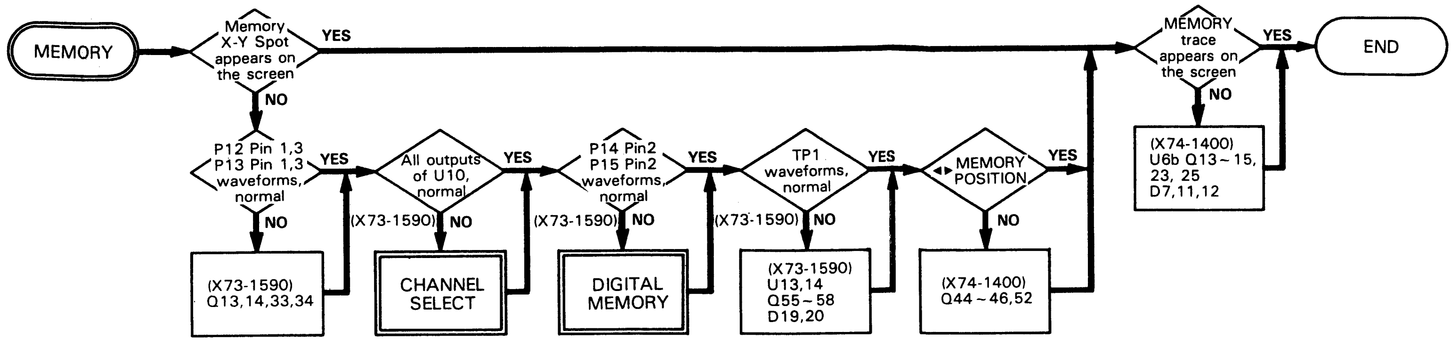

H.AMP
U8 1 X signal waveform normal
YES
(X74-1400)
NO
(X74-1400) Q39 ~ 41 D22
OUTPUT X + ,X – waveforms, normal
YES
(X74-1410)
NO
(X74-1400) U8 Q47 ~ 50 D26 (X74-1410) Q1,2 D1,2
END

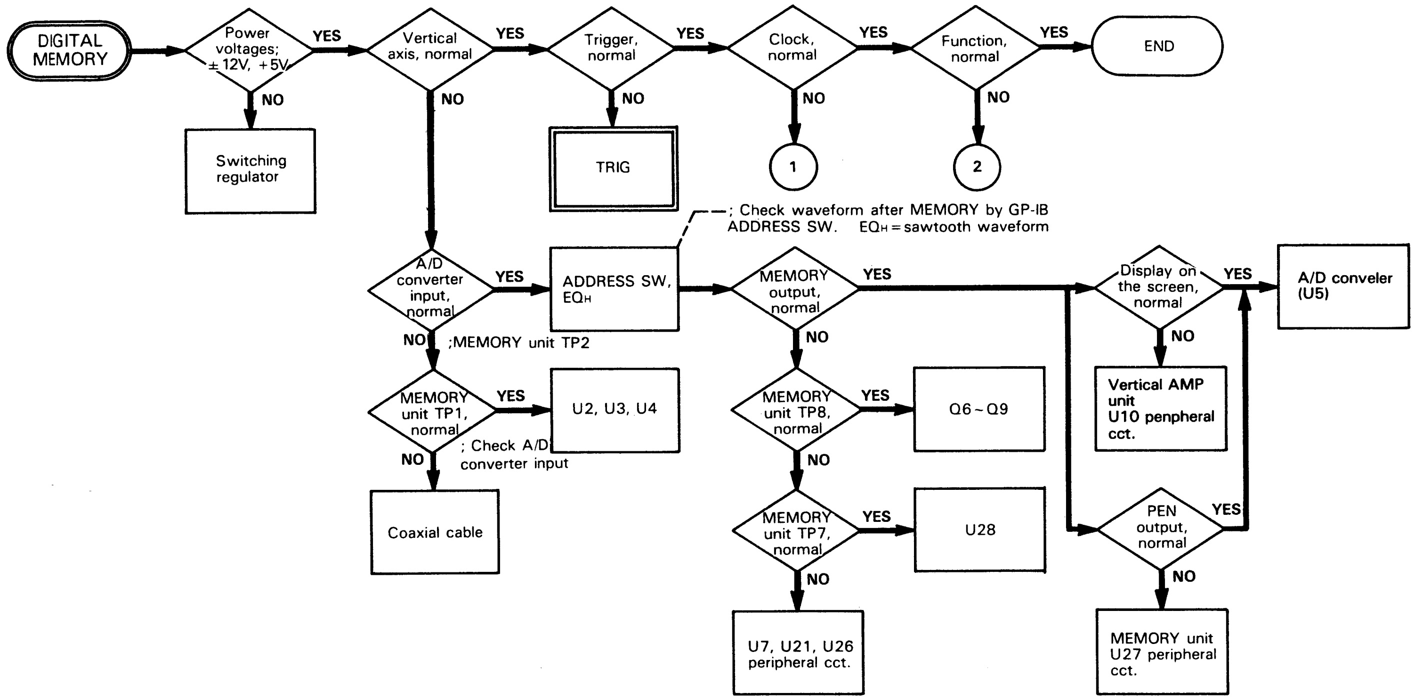

CH2
(X73-1590)
P47 Pin2 waveform, normal
YES
NO
(X77-1360-B/3) (ATTENUATOR UNIT) (X73-1580) Q3,4 D2
Q19a, 19b collector waveforms, normal
YES
NO
Q19,20
Q22 ~ 25 ON/OFF operation, normal
YES
NO
Q36 ~ 39 D5,6
Q22,23 (Q24,25) collector waveforms, normal
YES
NO
Q21 ~ 25,65, 66
TP1 waveforms, normal
YES
NO
U12 Q61,62 D4
END

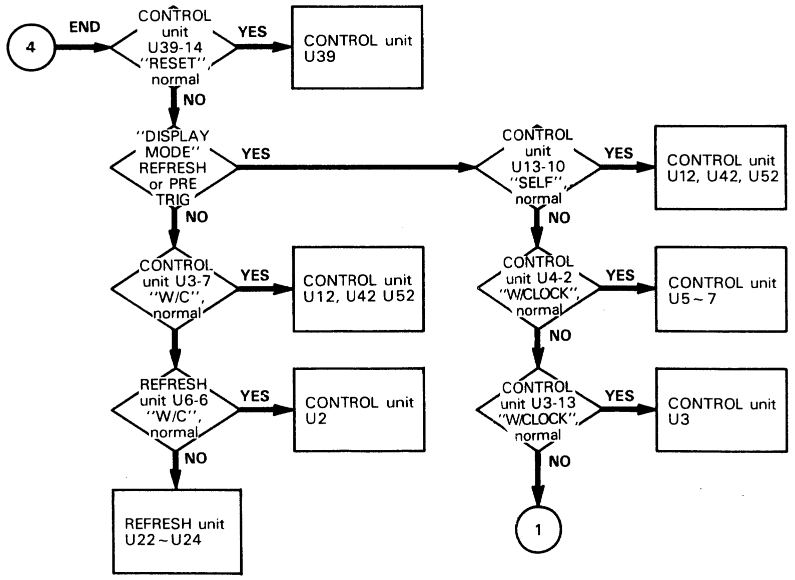

CHANNEL SELECT
(X73-1590)
P1 All signals, normal
YES
NO
(X77-1360-C/3) S3,4
P16 Pin6 (A1), Pin7 (A0) signals, normal
YES
NO
U1 ~ 4,6
P16 Pin3 (NTS) signal, normal
YES
NO
CONTROL UNIT (X77-1330)
U4-4 11 signal, normal
YES
NO
U2,4,5, 7 ~ 9
P16 Pin2 (OMC) signals, normal
YES
NO
SWITCH BOARD UNIT (X69-1030)
P19 Pin5 (OSC) signal, normal
YES
NO
(X74-1440) U1,4,5 D16,17
U10 4 (CR1) 7 (CR2) 9 (CM1) 12 (CM2) Channel select signals, normal
YES
NO
U5 ~ 7,9,10
P19 Pin2 (C/A) signal, normal
YES
NO
U3
END

TROUBLESHOOTING

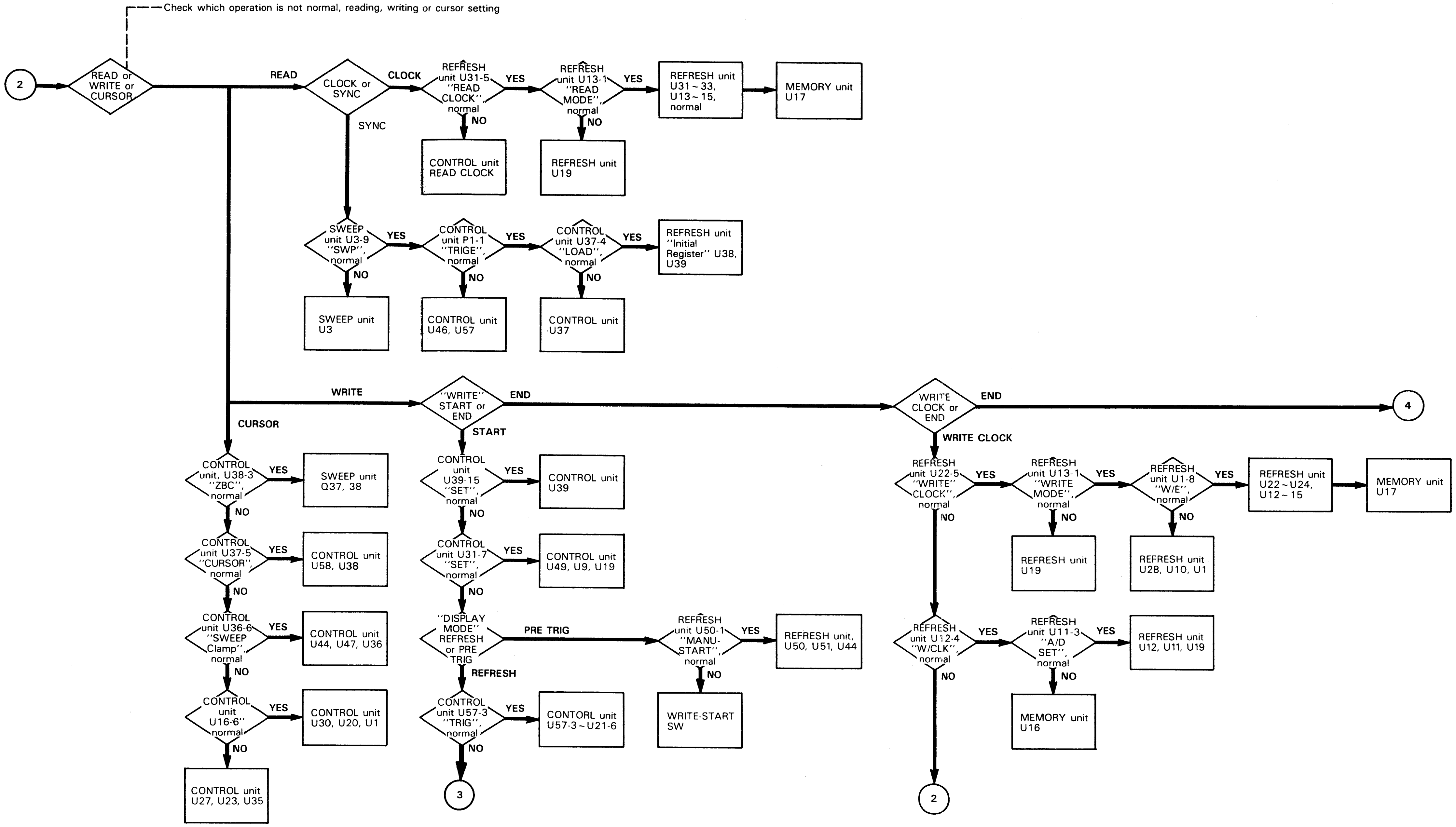

Into non-signal, and at AUTO
SWEEP
(X74-1400)
U1e 10 waveform, normal
YES
NO
TRIG
U5b 6 signal, "H"
YES
NO
U2b,4d,5b Q9
Q12 collector waveform, normal
YES
NO
U3b Q9 waveform, normal
YES
U6c Q10~12,16, 17,18 D6,8
NO
U3a Q̄ 6 waveform, normal
YES
U1a,6a,6d
NO
D13 Anode waveform, normal
YES
U3a,4a Q25,27,28 D13~15
NO
Q19~21,24 D9
U8 4 waveform, normal
YES
NO
Q22,42,43 D10,11,23
END


MEMORY
Memory X-Y Spot appears on the screen
YES
NO
P12 Pin 1,3 P13 Pin 1,3 waveforms, normal
YES
NO
(X73-1590) Q13,14,33,34
All outputs of U10, normal
YES
(X73-1590)
NO
CHANNEL SELECT
P14 Pin2 P15 Pin2 waveforms, normal
YES
(X73-1590)
NO
DIGITAL MEMORY
TP1 waveforms, normal
YES
(X73-1590)
NO
(X73-1590) U13,14 Q55~58 D19,20
◄► MEMORY POSITION
YES
NO
(X74-1400) Q44~46,52
MEMORY trace appears on the screen
YES
NO
(X74-1400) U6b Q13~15, 23, 25 D7,11,12
END

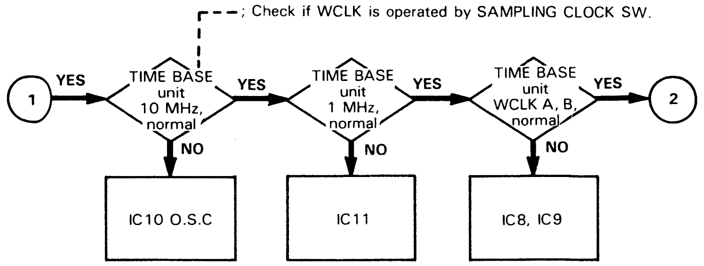

DIGITAL MEMORY
Power voltages; ±12V, +5V
YES
NO
Switching regulator
Vertical axis, normal
YES
NO
Trigger, normal
YES
NO
TRIG
Clock, normal
YES
NO
1
Function, normal
YES
NO
2
END
; Check waveform after MEMORY by GP-IB ADDRESS SW. EQH = sawtooth waveform
A/D converter input, normal
YES
NO
;MEMORY unit TP2
ADDRESS SW, EQH
MEMORY unit TP1, normal
YES
NO
; Check A/D converter input
U2, U3, U4
Coaxial cable
MEMORY output, normal
YES
NO
MEMORY unit TP8, normal
YES
NO
Q6~Q9
MEMORY unit TP7, normal
YES
NO
U28
U7, U21, U26 peripheral cct.
Display on the screen, normal
YES
NO
A/D conveler (U5)
Vertical AMP unit U10 penpheral cct.
PEN output, normal
YES
NO
MEMORY unit U27 peripheral cct.


4
END
CONTROL unit U39-14 "RESET", normal
YES
CONTROL unit U39
NO
"DISPLAY MODE" REFRESH or PRE TRIG
YES
NO
CONTROL unit U3-7 "W/C", normal
YES
CONTROL unit U12, U42 U52
REFRESH unit U6-6 "W/C", normal
YES
CONTROL unit U2
NO
REFRESH unit U22~U24
CONTROL unit U13-10 "SELF", normal
YES
CONTROL unit U12, U42, U52
NO
CONTROL unit U4-2 "W/CLOCK", normal
YES
CONTROL unit U5~7
NO
CONTROL unit U3-13 "W/CLOCK", normal
YES
CONTROL unit U3
NO
1

TROUBLESHOOTING


Check which operation is not normal, reading, writing or cursor setting

2
READ or WRITE or CURSOR
READ
CLOCK or SYNC
CLOCK
REFRESH unit U31-5 "READ CLOCK", normal
YES
REFRESH unit U13-1 "READ MODE", normal
YES
REFRESH unit U31～33, U13～15, normal
MEMORY unit U17
NO
CONTROL unit READ CLOCK
NO
REFRESH unit U19
SYNC
SWEEP unit U3-9 "SWP", normal
YES
CONTROL unit P1-1 "TRIGE", normal
YES
CONTROL unit U37-4 "LOAD", normal
YES
REFRESH unit "Initial Register" U38, U39
NO
SWEEP unit U3
NO
CONTROL unit U46, U57
NO
CONTROL unit U37
WRITE
"WRITE" START or END
END
WRITE CLOCK or END
END
4
CURSOR
CONTROL unit, U38-3 "ZBC", normal
YES
SWEEP unit Q37, 38
NO
CONTROL unit U37-5 "CURSOR", normal
YES
CONTROL unit U58, U38
NO
CONTROL unit U36-6 "SWEEP Clamp", normal
YES
CONTROL unit U44, U47, U36
NO
CONTROL unit U16-6" normal
YES
CONTROL unit U30, U20, U1
NO
CONTROL unit U27, U23, U35
START
CONTROL unit U39-15 "SET", normal
YES
CONTROL unit U39
NO
CONTROL unit U31-7 "SET", normal
YES
CONTROL unit U49, U9, U19
NO
"DISPLAY MODE" REFRESH or PRE TRIG
PRE TRIG
REFRESH unit U50-1 "MANU-START", normal
YES
REFRESH unit, U50, U51, U44
NO
WRITE-START SW
REFRESH
CONTROL unit U57-3 "TRIG", normal
YES
CONTORL unit U57-3～U21-6
NO
3
WRITE CLOCK
REFRESH unit U22-5 "WRITE" CLOCK", normal
YES
REFRESH unit U13-1 "WRITE MODE", normal
YES
REFRESH unit U1-8 "W/E", normal
YES
REFRESH unit U22～U24, U12～15
MEMORY unit U17
NO
REFRESH unit U19
NO
REFRESH unit U28, U10, U1
NO
REFRESH unit U12-4 "W/CLK", normal
YES
REFRESH unit U11-3 "A/D SET", normal
YES
REFRESH unit U12, U11, U19
NO
MEMORY unit U16
NO
2


; Check if WCLK is operated by SAMPLING CLOCK SW.

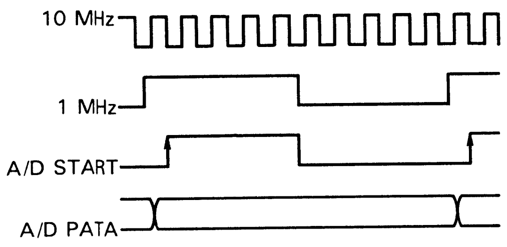
1
YES
TIME BASE unit 10 MHz, normal
YES
TIME BASE unit 1 MHz, normal
YES
TIME BASE unit WCLK A, B, normal
YES
2
NO
IC10 O.S.C
NO
IC11
NO
IC8, IC9

TROUBLESHOOTING

(1) A/D START

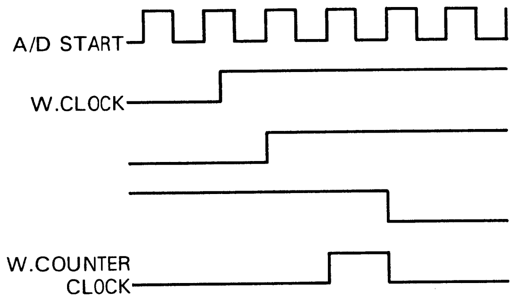
a) "L" during READ cycle

b) SAMPLING CLOCK 0.1m Sec max.


10 MHz
1 MHz
A/D START
A/D PATA

(2) WRITE COUNTER CLOCK

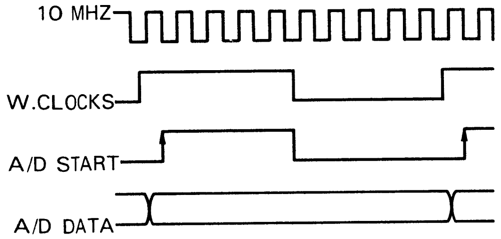
a) SHAMPLING CLOCK 0.1m Sec max.


A/D START
W.CLOCK
W.COUNTER CLOCK

b) OAMPLING CLOCK 50μ Sec min.

A/D START = W.COUNTER CLOCK

c) SHAMPLING CLOCK 50μ Sec max.


10 MHZ
W.CLOCKS
A/D START
A/D DATA

(3) READ/WRITE SELECTOR

a) SAMPLING CLOCK 0.1m Sec max.

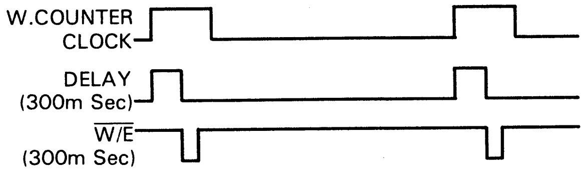
W.COUNTER CLOCK = R/W SELECT

b) SAMPLING CLOCK 50μ Sec min.

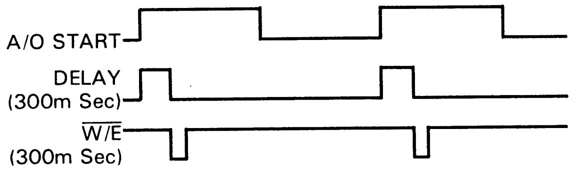
$\bar{R}$/W C = $\bar{R}$/W SELECT

(4) $\overline{W/E}$

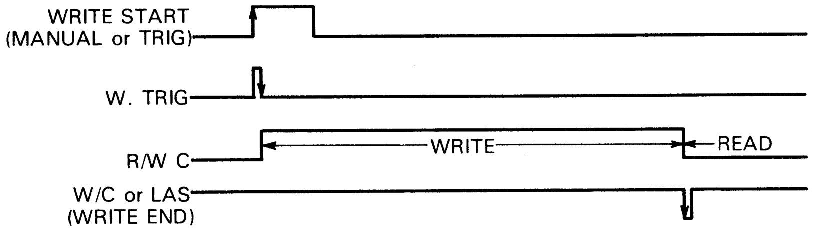
a) SAMPLING CLOCK 0.1m Sec max.


W.COUNTER CLOCK
DELAY (300m Sec)
W/E (300m Sec)

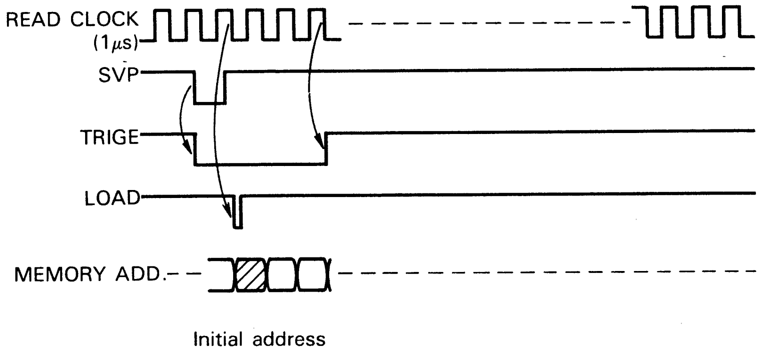
b) SAMPLING CLOCK 50μ Sec min.


A/O START
DELAY (300m Sec)
W/E (300m Sec)

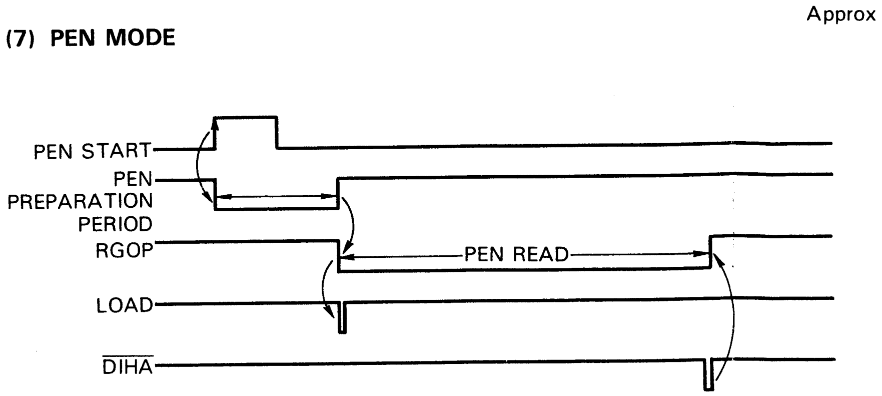
(5) WRITE MODE


WRITE START (MANUAL or TRIG)
W. TRIG
R/W C
WRITE
READ
W/C or LAS (WRITE END)

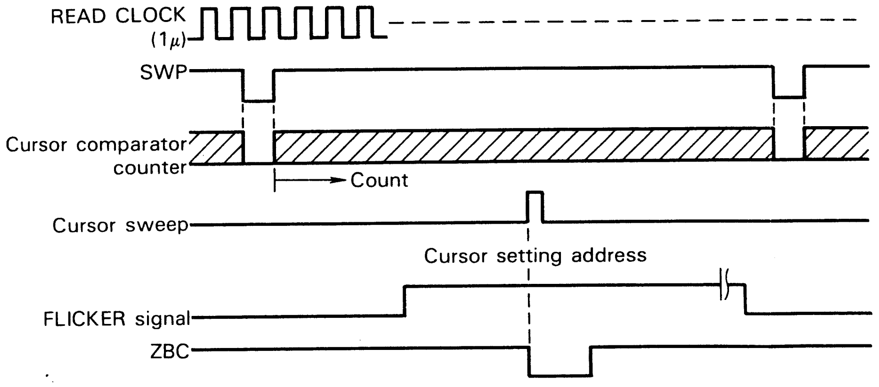
(6) READ MODE


READ CLOCK (1μs)
SVP
TRIGE
LOAD
MEMORY ADD.
Initial address

(7) PEN MODE


Approx
PEN START
PEN PREPARATION PERIOD
RGOP
PEN READ
LOAD
DIHA

(8) CURSOR OUT


READ CLOCK (1μ)
SWP
Cursor comparator counter
Count
Cursor sweep
Cursor setting address
FLICKER signal
ZBC

TROUBLESHOOTING

		MODE	$\overline{\text{OMC}}$	NTS		A0	A1	A2	C/A	U9 4 PR	U9 15 CLR	U9 1 CK	CR1	CR2	CM1	CM2	U4 11 CADD
OSCILLO		CH1	L	L		L	H	H	L	L	H	H	H	L	L	L	H
		CH2	L	L		H	L	H	L	H	L	L	L	H	L	L	H
	DUAL	ALT	L	L		H	H	H	L	H	H	(Fig 1)			L	L	H
		CHOP							H			(Fig 2)					
		ADD	L	L		L	L	H	L	L	L	H	H	H	L	L	L
		X-Y	L	L		L	H	L	L	L	H	H	H	L	L	L	H
MEMORY	NORM	CH1	H	L		L	H	H	L	L	H	H	L	L	H	L	H
		CH2	H	L		H	L	H	L	H	L	H	L	L	L	H	H
		DUAL	H	L		H	H	H	L	H	H	(Fig3)	L	L	(Fig 3)		H
		ADD	H	L		L	L	H	L	H	L	H	L	L	L	H	H
		X-Y	H	L		L	H	L	L	L	H	H	L	L	H	L	H
	DELAY	CH1	H	H	H	L	H	H	L	H	H	(Fig 3)	L	L	(Fig 3)		H
		CH2	H	H	H	H	L	H	L	H	H		L	L			H
		DUAL	H	L	H	H	H	H	L	H	H		L	L			H
		ADD	H	H	H	L	L	H	L	H	H		L	L			H
		X-Y	H	L	H	L	H	L	L	L	H	H	L	L	H	L	H
				REFRESH	PRE TRIG												

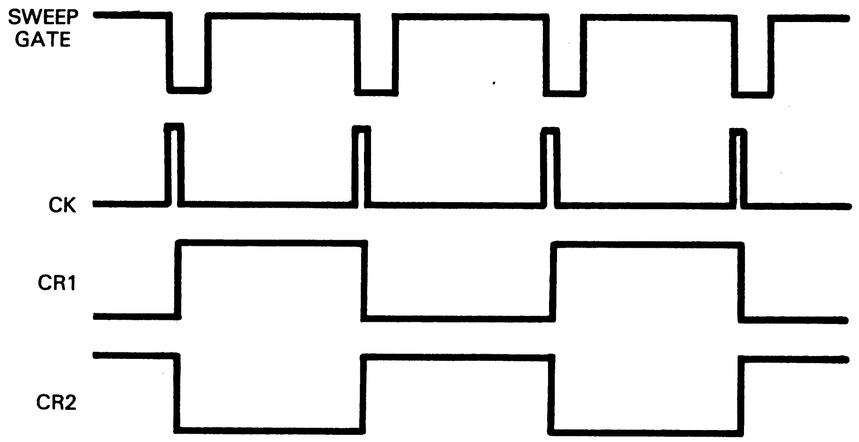


Fig. 1

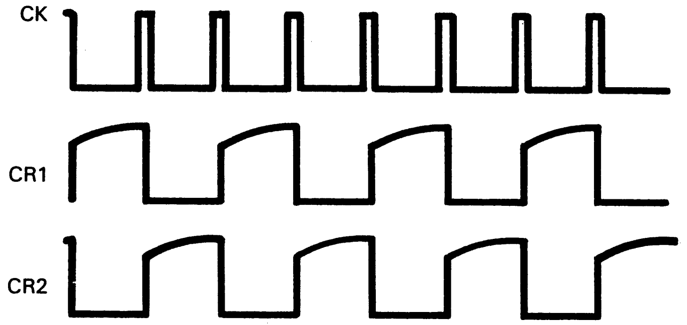


Fig. 2

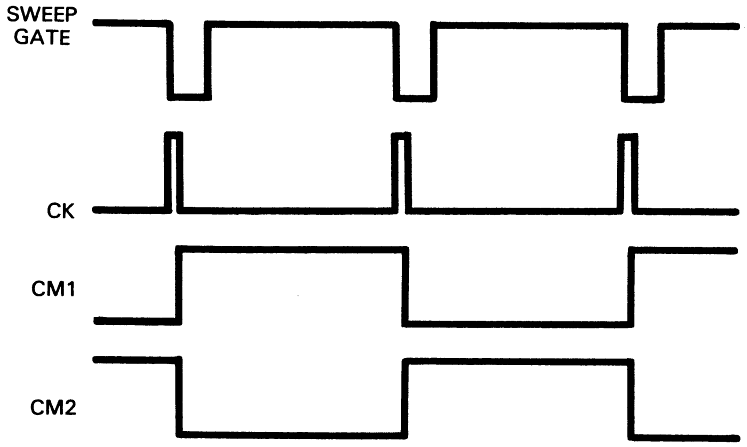


Fig. 3

PARTS LIST

MS-1660 MAIN CHASSIS

Y72-1030-61

REF.NO	PARTS NO	NAME & DESCRIPTION
1	A01-0274-05	CASE
2	A01-1135-02	CASE
3	A01-1136-02	CASE
4	A10-1442-02	CHASSIS
5	A11-0503-13	SUB CHASSIS
6	A13-0736-13	FRAME
7	A13-0738-03	FRAME
8	A13-0781-15	FRAME
9	A13-0784-02	FRAME
10	A21-1070-02	DECORATIVE PANEL
11	A22-0843-02	SUB PANEL
12	A23-1656-22	REAR PANEL
—	A33-0502-05	REFLECTOR W/LAMP ASS'Y
—	A33-0503-05	REFLECTOR W/LAMP ASS'Y
13	A50-0506-13	SIDE PANEL
14	A50-0507-13	SIDE PANEL
15	A50-0508-13	SIDE PANEL
16	A50-0509-13	SIDE PANEL
17	B07-0122-04	ESCUTCHEON
18	B07-0706-04	ESCUTCHEON
19	B07-0712-13	ESCUTCHEON FOR FILTER
20	B19-0726-04	FILTER
—	B30-0941-05	LAMP
21	B30-0949-05	LAMP ASS'Y
22	B30-0950-05	LAMP ASS'Y(ILLUM)
—	B40-2765-04	NAME PLATE (SERIAL NO)
—	B41-0710-04	CAUTION LABEL (HIGH VOLTAGE)
—	B41-0717-14	CAUTION LABEL
—	B50-7559-20	INSTRUCTION MANUAL
23	E01-1403-05	CRT SOCKET
24	E04-0251-05	BNC RECEPTACLE
25	E21-0209-13	DUAL BINDING POST
26	E21-0654-04	TERMINAL (CAL)
27	E21-0657-04	TERMINAL (GND)
—	E23-0513-05	EARTH LUG
—	E23-0520-05	EARTH LUG
—	E23-0557-04	EARTH LUG
28	E29-0506-04	SHORTING BAR (PANEL)
—	E30-1819-05	CEE CORD
—	E31-0564-05	LEAD WIRE WITH CONNECTOR
—	E31-2542-05	LEAD WIRE WITH CONNECTOR
—	E33-4083-00	WIRE ASSY
—	F01-0848-04	HEAT SINK
—	F06-5015-05	FUSE 0.5A
29	F09-0041-05	FAN
30	F10-1575-13	SHIELD PLATE
31	F10-1594-03	SHIELD PLATE
32	F10-1595-04	SHIELD PLATE
33	F10-1596-03	SHIELD PLATE
34	F11-0990-13	SHIELD CASE
—	F15-0733-04	FELT
—	F15-0735-04	SHEET
—	F20-0516-05	INSULATOR
35	F20-0649-04	INSULATOR
36	G02-0607-04	SPRING FOR CRT
37	G16-0611-04	REFLECTOR SHEET (L)
38	G16-0612-04	REFLECTOR SHEET (R)
39	G16-0614-04	REFLECTOR SHEET
—	H01-5759-14	CARTON BOX
—	H10-2819-02	FOAMED STYRENE PAD
—	H20-1721-04	VINYL COVER
—	H25-0029-04	POLYETHYLENE BAG (FUSE)
40	J02-0089-05	RUBBER LEG
41	J02-0512-05	LEG
42	J10-0100-22	BEZEL
43	J13-0033-15	FUSE HOLDER
—	J19-1620-05	CORD CLAMP
—	J19-1633-13	HOLDER FOR CRT
44	J19-1634-04	HOLDER FOR LEAD
45	J21-1425-04	MOUNTING HARDWARE
—	J21-2816-04	BLACKET FOR VR
—	J21-2912-05	HOLDER FOR LED
46	J21-2970-23	BLACKET FOR CRT
47	J21-4512-04	BLACKET FOR CRT
47-1	J21-4516-04	BLACKET FOR PCB
48	J21-4517-03	MOUNTING HARDWARE
49	J21-4518-03	BLACKET FOR PCB
50	J21-4519-03	BLACKET FOR PCB
51	J21-4521-04	MOUNTING HARDWARE
52	J21-4522-04	MOUNTING HARDWARE
53	J21-4523-04	MONTING HRADWARE
—	J32-0780-04	BOSS
—	J32-0844-04	BOSS
—	J32-0860-04	BOSS
54	J42-0523-04	BUSHING
—	J42-0529-04	BUSHING
—	J59-0403-05	NYLON RIVET
—	J61-0049-05	WIRE BAND
55	J61-0516-05	SUPPORT (T TYPE)
—	J61-0518-05	SUPPORT (T TYPE)
56	J90-0502-05	GUIDE
57	K01-0523-05	HANDLE
58	K21-0868-03	KNOB
59	K21-0869-04	KNOB
60	K21-0870-04	KNOB
61	K21-0872-04	KNOB
62	K21-0879-03	KNOB
63	K21-0883-04	KNOB
63-1	K27-0530-14	KNOB
64	K27-0531-04	KNOB
65	K27-0533-04	KNOB
66	K27-0534-04	KNOB
67	K29-0186-05	KNOB
68	L01-9456-15	POWER TRANSFORMER
69	L39-0521-15	COIL
70	L79-0502-05	LINE FILTER
—	N09-0710-05	SCREW, SEMS PAN HD
—	N09-0711-05	SCREW
71	N09-0715-05	SCREW
—	N09-0718-05	SCREW
—	N09-0747-04	SCREW
—	N10-2030-46	NUT, HEX
—	N10-2060-46	NUT
—	N14-0602-34	NUT
—	N14-0603-34	NUT
—	N15-1030-41	WASHER, FLAT FOR M3
—	N16-0030-46	SPRING WASHER
—	N17-1030-41	LOCK WASHER
—	N17-1060-46	LOCK WASHER
—	N19-0191-05	WASHER NONMETAL
—	N19-0702-04	WASHER
—	N19-0704-04	WASHER
—	N30-3006-41	SCREW, PAN HD M 3X6
—	N30-3008-41	SCREW, PAN HD M 3X8
—	N30-3010-41	SCREW, PAN HD M 3X10
—	N30-3016-41	SCREW, PAN HD M 3X16
—	N30-4012-41	SCREW, PAN HD M 4X12
—	N32-3006-41	SCREW, FLAT HD M 3X6
—	N32-3008-41	SCREW, FLAT HD M 3X8
—	N32-3010-41	SCREW, FLAT HD M 3X10
—	N34-3012-41	SCREW, TRUSS M 3X8
—	N88-3008-41	SCREW, FLAT HD TAP TITE
—	N89-3006-41	SCREW, BINDING TAP TITE
—	N89-3008-41	SCREW, BINDING TAP TITE
—	N89-3010-41	SCREW, BINDING TAP TITE
—	RD14BB2E151J	RES. CARBON 150 5% 1/4W
72	S02-4503-05	ROTARY SWITCH
73	T40-0022-05	INDUCTION MOTOR
74	W01-0507-03	CORD WRAP
75	W02-0420-15	SWITCHING POWER SUPPLY
—	X68-1420-00	POWER SUPPLY UNIT
76	X69-1030-01	SWITCH BOARD
77	X71-1120-00	TIME BASE UNIT
78	X73-1580-00	VERTICAL HEAD AMP UNIT
79	X73-1590-00	VERTICAL AMP UNIT
80	X74-1400-00	SWEEP UNIT
81	X74-1410-00	HORIZONTAL OUTPUT UNIT
82	X77-1020-03	VOLTAGE SELECTOR
83	X77-1330-00	CONTROL UNIT
84	X77-1360-00	VERTICAL SWITCH UNIT
85	X81-1440-01	MOTHER BOARD UNIT
86	X81-1450-00	REFRESH UNIT
87	X81-1460-00	MEMORY UNIT
88	X81-1500-00	GP-IB INTERFACE UNIT
89	X81-1510-00	CONNECTOR BOARD UNIT
—	Y87-2260-00	PROBE PC-30
—	002-0001-05	BRAIDED WIRE
90	150FTM31	CRT
—	212-2014-05	TUBE (PLASTIC)
— J001	E31-2532-15	LEAD WIRE WITH CONNECTOR
— J002	E31-2531-05	LEAD WIRE WITH CONNECTOR
— J003	E31-2531-05	LEAD WIRE WITH CONNECTOR
— J004	E31-2531-05	LEAD WIRE WITH CONNECTOR
— J005	E31-2531-05	LEAD WIRE WITH CONNECTOR

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
— J006	E31-2610-05	LEAD WIRE WITH CONNECTOR
— J007	E31-2608-05	LEAD WIRE WITH CONNECTOR
— J008	E31-2608-05	LEAD WIRE WITH CONNECTOR
— J009	E31-2608-05	LEAD WIRE WITH CONNECTOR
— J010	E31-2608-05	LEAD WIRE WITH CONNECTOR
— J011	NO USE	
— J012	E31-2540-05	LEAD WIRE WITH CONNECTOR
— J013	E31-2540-05	LEAD WIRE WITH CONNECTOR
— J020	E31-2540-05	LEAD WIRE WITH CONNECTOR
— J021	NO USE	
— J022	E31-2536-15	LEAD WIRE WITH CONNECTOR
— J023	E31-2536-15	LEAD WIRE WITH CONNECTOR
— J024	E31-2600-05	LEAD WIRE WITH CONNECTOR
— J034	E31-2535-05	LEAD WIRE WITH CONNECTOR
— J035	E31-2537-15	LEAD WIRE WITH CONNECTOR
— J036	E31-2537-15	LEAD WIRE WITH CONNECTOR
— J039	E31-2534-05	LEAD WIRE WITH CONNECTOR
— J040	E31-2534-05	LEAD WIRE WITH CONNECTOR
— J041	NO USE	
— J042	E31-2534-05	LEAD WIRE WITH CONNECTOR
— J047	E31-2609-05	LEAD WIRE WITH CONNECTOR
— J048	E31-2538-05	LEAD WIRE WITH CONNECTOR
— J048	E31-2785-15	LEAD WIRE WITH CONNECTOR
— J049	E31-2538-05	LEAD WIRE WITH CONNECTOR
— J050	E31-2530-15	LEAD WIRE WITH CONNECTOR
— J051	E31-2530-15	LEAD WIRE WITH CONNECTOR
— J052	E31-2530-15	LEAD WIRE WITH CONNECTOR
— J053	E31-2530-15	LEAD WIRE WITH CONNECTOR
— J054	E31-2530-15	LEAD WIRE WITH CONNECTOR
— J055	E31-2529-05	LEAD WIRE WITH CONNECTOR
— J056	E31-2529-05	LEAD WIRE WITH CONNECTOR
— J057	E31-2529-05	LEAD WIRE WITH CONNECTOR
— J064	E31-2541-35	LEAD WIRE WITH CONNECTOR
— J065	E31-2541-35	LEAD WIRE WITH CONNECTOR
— J070	E31-2704-25	LEAD WIRE WITH CONNECTOR
— J071	E31-2705-05	LEAD WIRE WITH CONNECTOR
— J072	E31-2733-05	LEAD WIRE WITH CONNECTOR
— J073	E31-2749-05	LEAD WIRE WITH CONNECTOR
— J074	E31-2601-05	LEAD WIRE WITH CONNECTOR
— J075	E31-2602-15	LEAD WIRE WITH CONNECTOR
— L001	L40-1592-13	FERRI INDUCTOR 10UH
— L002	L40-1592-13	FERRI INDUCTOR 10UH
— Q001	2SB940A(P)	TR. SI, PNP
— Q002	2SC2591(R)	TR. SI, NPN
— Q003	2SA1111(Q)	TR. SI, PNP
— Q004	2SD1263A(P)	TR, SI, NPN
— Q005	2SC1505	TR. SI, NPN
— Q006	2SD401A	TR. SI, NPN
91 S001	S02-1501-05	ROTARY SWITCH
92 TH001	4W25	POWER THERMISTER
93 VR001	R01-1011-05	V.R. 1K B
94 VR002	R01-1011-05	V.R. 1K B
95 VR003	R01-0041-05	V.R. 500 B
96 VR004	R01-0041-05	V.R. 500 B
97 VR005	R19-9508-05	V.R. 500 B,250K B
98 VR006	R01-3027-05	V.R. 10K B
99 VR007	R03-2507-05	V.R. 5K B
100 VR008	R05-8001-05	V.R. 3M B
101 VR009	R19-9508-05	V.R. 500 B,250K B
102 VR010	R01-8504-05	V.R. 2M B

POWER SUPPLY UNIT

X68-1420-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	F01-0848-04	HEAT SINK			
	F20-0516-05	INSULATOR			
	J21-2905-14	BLACKET FOR PCB			
	J25-5078-13	PCB (UNMOUNTED)			
	J61-0049-05	WIRE BAND			
	N09-0718-05	SCREW			
	N19-0191-05	WASHER NONMETAL			
	N30-3008-41	SCREW, PAN HD	M 3X8		
	212-2014-05	TUBE (PLASTIC)			
C001	CE04BW1H010M	CAP. ELECTRO	1	20%	50V
C002	CE04W1V222M	CAP. ELECTRO	2200	20%	35V
C003	NO USE				
C004	CE04W1E471M	CAP. ELECTRO	470	20%	25V
C005	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C006	CE04W1C221M	CAP. ELECTRO	220	20%	16V
C007	CE04W1V222M	CAP. ELECTRO	2200	20%	35V
C008	NO USE				
C009	CE04W1E471M	CAP. ELECTRO	470	20%	25V
C010	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C011	CE04W1H471M	CAP. ELECTRO	470	20%	50V
C012	NO USE				
C013	CE04W1E471M	CAP. ELECTRO	470	20%	25V
C014	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C015	C90-0954-05	CAP. ELECTRO	33		350V
C016	CE04W2E100	CAP. ELECTRO	10		250V
C017	CE04W2E100	CAP. ELECTRO	10		250V
C018	NO USE				
C019	CE04W2E100	CAP. ELECTRO	10		250V
C020	CE04W2E100	CAP. ELECTRO	10		250V
C021	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C022	CE04W1C471M	CAP. ELECTRO	470	20%	16V
C023	CQ92M1H104K	CAP. MYLAR	0.1	10%	50V
C024	CE04W1E471M	CAP. ELECTRO	470	20%	25V
C025	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C026	CE04W1E331M	CAP. ELECTRO	330	20%	25V
C027	CQ93M1H223K	CAP. MYLAR	0.022	10%	50V
C028	CK45E3D102P	CAP. CERAMIC	1000P		2K
C029	C91-0571-05	CAP. CERAMIC	0.01		2KV
C030	C91-0571-05	CAP. CERAMIC	0.01		2KV
C031	C91-0571-05	CAP. CERAMIC	0.01		2KV
C032	C91-0571-05	CAP. CERAMIC	0.01		2KV
C033	C91-0571-05	CAP. CERAMIC	0.01		2KV
C034	C91-0571-05	CAP. CERAMIC	0.01		2KV
C035	C91-0571-05	CAP. CERAMIC	0.01		2KV
C036	C91-0571-05	CAP. CERAMIC	0.01		2KV
C039	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C040	NO USE				
C041	CE04W2E3R3	CAP. ELECTRO	3.3		250V
C042	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C043	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
C044	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C045	CE04W1C330M	CAP. ELECTRO	33	20%	16V
C046	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C047	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
D001	S2VB40F	DIODE, BRIDGE			
D002	S1VB60	DIODE			
D003	S1VB60	DIODE			
D004	MTZ16JA	DIODE ZENER	15V		
D005	MTZ5.1JB	DIODE ZENER	5V		
D006	MTZ16JA	DIODE ZENER	15V		
D007	MTZ16JA	DIODE ZENER	15V		
D008	1SS132	DIODE			
D009	Y16JA	DIODE			
D010	W02-0401-05	HIGH VOL.RECTIFIER			
D011	V11-N	DIODE			
D012	V11-N	DIODE			
D013	MTZ5.1JB	DIODE ZENER	5V		
D014	NO USE				
D015	1SS132	DIODE			
D016	1SS83	DIODE			
D017	1SS83	DIODE			
D018	MTZ9.1JC	DIODE ZENER	9V		
D019	1SS132	DIODE			
D020	1SS132	DIODE			
D021	MTZ5.1JB	DIODE ZENER	5V		
D022	MTZ5.1JB	DIODE ZENER	5V		
D023	1SS132	DIODE			
D024	1SS132	DIODE			
D025	1SS132	DIODE			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
D026	1SS132	DIODE
D027	1SS132	DIODE
J064	E31-2541-35	LEAD WIRE WITH CONNECTOR
J065	E31-2541-35	LEAD WIRE WITH CONNECTOR
L001	L40-1025-04	FERRI INDUCTOR 1.0MH
L002	L40-1011-04	FERRI INDUCTOR 100UH
L003	L40-1011-04	FERRI INDUCTOR 100UH
L004	L40-4791-02	FERRI INDUCTOR 4.7UH
N001	NE-2B	NEON LAMP
N002	NE-2B	NEON LAMP
P021	E40-0673-05	PIN CONNECTOR 6 P
P030	E40-0273-05	PIN CONNECTOR 2 P
P031	E40-0273-05	PIN CONNECTOR 2 P
P032	E40-0573-05	PIN CONNECTOR 5 P
P037	E40-0273-05	PIN CONNECTOR 2 P
P038	E40-0273-05	PIN CONNECTOR 2 P
P039	E40-0330-05	PIN CONNECTOR 3 P
P040	E40-0530-05	PIN CONNECTOR 5 P
P041	E40-0373-05	PIN CONNECTOR 3 P
P042	E40-0273-05	PIN CONNECTOR 2 P
P043	E40-0373-05	PIN CONNECTOR 3 P
P044	E40-0273-05	PIN CONNECTOR 2 P
P045	E40-0530-05	PIN CONNECTOR 5 P
P046	E40-0230-05	PIN CONNECTOR 2 P
P047	NO USE	
P048	E40-0373-05	PIN CONNECTOR 3 P
P064	E40-0973-05	PIN CONNECTOR 9 P
P065	E40-0673-05	PIN CONNECTOR 6 P
P072	E40-0273-05	PIN CONNECTOR 2 P
Q001	2SB940A(P)	TR. SI, PNP
Q002	2SC2591(R)	TR. SI, NPN
Q003	2SA1111(Q)	TR. SI, PNP
Q004	2SD1263A(P)	TR, SI, NPN
Q005	2SC1505	TR. SI, NPN
Q006	2SC2271	TR. SI, NPN
Q007	2SD401A	TR. SI, NPN
Q008	2SC3311(Q,R)	TR. SI, NPN
Q009	2SA1309(Q,R)	TR. SI, PNP
Q010	2SA1210(S)	TR. SI, PNP
Q011	2SC2912(S)	TR. SI, NPN
Q012	2SC3315(C,D)	TR. SI, NPN
Q013	2SC3311(Q,R)	TR. SI, NPN
Q014	2SC2912(S)	TR. SI, NPN
R001	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R002	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
R003	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W
R004	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R005	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W
R006	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R007	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W
R008	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R009	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R010	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R011	RN14BK2C2002F	RES. METAL FILM 20K 1% 1/6W
R012	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R013	RS14AB3D622J	RES. METAL FILM 6.2K 5% 2W
R014	RS14AB3D622J	RES. METAL FILM 6.2K 5% 2W
R015	RD14BB2C821J	RES. CARBON 820 5% 1/6W
R016	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R017	RD14BB2C4R7J	RES. CARBON 4.7 5% 1/6W
R018	NO USE	
R019	RN14BK2C3000F	RES. METAL FILM 300 1% 1/6W
R020	RN14BK2C6201F	RES. METAL FILM 6.2K 1% 1/6W
R021	RN14BK2C9102F	RES. METAL FILM 91K 1% 1/6W
R022	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R023	RN14BK2C1103F	RES. METAL FILM 110K 1% 1/6W
R024	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R025	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R026	RD14BB2C563J	RES. CARBON 56K 5% 1/6W
R027	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R028	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R029	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R030	RD14BY2H4R7J	RES. CARBON 4.7 5% 1/2W
R031	RD14BY2H472J	RES. CARBON 4.7K 5% 1/2W
R032	RD14BY2H473J	RES. CARBON 47K 5% 1/2W
R033	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R034	R92-0756-05	RES. FIXED 47M 5% 1/2W
R035	R92-1031-05	RES. FIXED 4.7M 5% 1/2W
R036	R92-0800-05	RES. FIXED 10M 5% 1W
R037	R92-0800-05	RES. FIXED 10M 5% 1W
R038	NO USE	
R039	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R040	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R041	RD14BB2C511J	RES. CARBON 510 5% 1/6W
R042	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R043	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R044	NO USE	
R045	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R046	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R047	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R048	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R049	RD14BY2H472J	RES. CARBON 4.7K 5% 1/2W
R050	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R051	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R052	RD14BB2C123J	RES. CARBON 12K 5% 1/6W
R053	RD14BB2C224J	RES. CARBON 220K 5% 1/6W
R054	RD14BB2C363J	RES. CARBON 36K 5% 1/6W
R055	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R056	RD14BB2C333J	RES. CARBON 33K 5% 1/6W
R057	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R058	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R059	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R060	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R061	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R062	NO USE	
R063	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R064	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R065	RD14BY2H220J	RES. CARBON 22 5% 1/2W
R066	RD14BB2C681J	RES. CARBON 680 5% 1/6W
R067	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R068	RD14BB2C154J	RES. CARBON 150K 5% 1/6W
R069	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R070	RD14BB2C101J	RES. CARBON 100 5% 1/6W
T001	L19-0417-05	CONVERTOR TRANSFORMER
TC001	C05-0401-05	CAP. TRIMMER 20P
U001	NJM4556D	
U002	NJM4556D	
VR001	R12-1029-05	RES. SEMI FIXED 1K B
VR002	R12-3502-05	RES. SEMI FIXED 33K B
VR003	R12-3042-05	RES. SEMI FIXED 47K B

PARTS LIST

SWITCH BOARD UNIT

X69-1030-01

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E40-0218-05	PIN CONNECTOR	2 P		
	J25-5052-13	PCB (UNMOUNTED)			
	J30-0617-04	SPACER			
	K29-0808-05	KNOB			
D001	LN322GP	DIODE			
D002	LN322GP	DIODE			
D003	LN222RP	LED			
D004	LN222RP	LED			
D005	LN322GP	DIODE			
D006	LN322GP	DIODE			
D007	LN322GP	DIODE			
D008	LN322GP	DIODE			
D009	LN322GP	DIODE			
D010	1SS132	DIODE			
D011	1SS132	DIODE			
P001	E40-2686-05	PIN CONNECTOR	26P		
P002	E40-0473-05	PIN CONNECTOR	4 P		
P003	E40-0473-05	PIN CONNECTOR	4 P		
R001	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R002	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R003	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R004	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R005	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R006	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R007	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R008	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R009	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
S001	S42-5507-05	PUSH SWITCH			
S002	S42-5508-05	PUSH SWITCH			
S003	S40-2520-05	PUSH SWITCH			
S004	S40-1520-05	PUSH SWITCH			
S005	S40-1520-05	PUSH SWITCH			

TIME BASE UNIT

X71-1120-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5053-02	PCB (UNMOUNTED)			
	R92-1061-05	JUMPING RES.	ZERO OHM		
C001	CK45B1H472K	CAP. CERAMIC	4700P	10%	50V
C002	CC45SL1H220J	CAP. CERAMIC	22P	5%	50V
C003	CE04W1C221M	CAP. ELECTRO	220	20%	16V
C004	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C005	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C006	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C007	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C008	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C009	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C010	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
IC001	SN74LS157N	IC			
IC002	SN74LS148N	IC			
IC003	SN74LS148N	IC			
IC004	SN74LS157N	IC			
IC005	SN74LS148N	IC			
IC006	SN74LS148N	IC			
IC007	SN74LS21N	IC			
IC008	8650-0	IC			
IC009	8650-0	IC			
IC010	SN74LS04N	IC			
IC011	SN74LS90N	IC			
P001	E40-2086-05	PIN CONNECTOR	20P		
P002	E40-0473-05	PIN CONNECTOR	4 P		
R001	RD14BB2B471J	RES. CARBON	470	5%	1/8W
R002	RD14BB2B471J	RES. CARBON	470	5%	1/8W
R003	R90-0609-05	RES. NETWORK	4.7K		
R004	R90-0609-05	RES. NETWORK	4.7K		
R005	R90-0609-05	RES. NETWORK	4.7K		
R006	R90-0609-05	RES. NETWORK	4.7K		
R007	R90-0609-05	RES. NETWORK	4.7K		
S001	S01-2513-05	ROTARY SWITCH			
S002	S01-2513-05	ROTARY SWITCH			
X001	L77-1002-05	CRYSTAL RESONATOR			

VERTICAL HEAD AMP UNIT

X73-1580-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J21-4520-04	MOUNTING HARDWARE			
	J25-5079-24	PCB (UNMOUNTED)			
	N09-0718-05	SCREW			
	002-0001-05	BRAIDED WIRE			
	212-7004-05	TUBE (PLASTIC)			
	420-0008-05	ADHESIVES			
C001	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C002	NO USE				
C003	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C004	NO USE				
C005	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C006	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C007	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C008	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C009	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C010	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C011	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C012	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C013	CC45CH1H020C	CAP. CERAMIC	2P	0.25P	50V
D001	1S1544A	DIODE			
D002	1S1544A	DIODE			
J001	R92-1061-05	JUMPING RES.	ZERO OHM		
J002	R92-1061-05	JUMPING RES.	ZERO OHM		
J003	R92-1061-05	JUMPING RES.	ZERO OHM		
J004	R92-1061-05	JUMPING RES.	ZERO OHM		
J005	R92-0150-05	JUMPING RES.	ZERO OHM		
J006	R92-0150-05	JUMPING RES.	ZERO OHM		
J007	R92-1061-05	JUMPING RES.	ZERO OHM		
L001	L40-1011-04	FERRI INDUCTOR	100UH		
L002	L40-1011-04	FERRI INDUCTOR	100UH		
P011	E40-0916-05	PIN CONNECTOR	9P		
P047	E40-0273-05	PIN CONNECTOR	2 P		
Q001	DN1901	FET, DUAL SI, N-CHANNEL			
Q002	2SC3066(F,G)	TR. SI, NPN			
Q003	DN1901	FET, DUAL SI, N-CHANNEL			
Q004	2SC3066(F,G)	TR. SI, NPN			
R001	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R002	RN14BK2E1004F	RES. METAL FILM	1M	1%	1/4W
R003	RD14BB2E474J	RES. CARBON	470K	5%	1/4W
R004	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R005	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R006	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R007	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R008	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R009	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R010	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R011	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R012	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R013	RN14BK2E1004F	RES. METAL FILM	1M	1%	1/4W
R014	RD14BB2E474J	RES. CARBON	470K	5%	1/4W
R015	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R016	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R017	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R018	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R019	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R020	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R021	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R022	RD14BB2C101J	RES. CARBON	100	5%	1/6W
T003	E23-0503-05	TERMINAL			
T004	E23-0503-05	TERMINAL			
T005	E23-0503-05	TERMINAL			
T006	E23-0503-05	TERMINAL			
T007	E29-0504-05	TEFLON TERMINAL			
T008	E29-0504-05	TEFLON TERMINAL			
VR001	R12-0567-05	RES. SEMI FIXED	500 B		
VR002	R12-0567-05	RES. SEMI FIXED	500 B		

PARTS LIST

VERTICAL AMP UNIT

X73-1590-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E23-0503-05	TERMINAL			
	E33-4103-00	WIRE ASSY			
	F01-0813-05	HEAT SINK			
	F01-0849-05	HEAT SINK			
	F15-0727-04	HOLDER (NEON TUBE)			
	F20-0516-05	INSULATOR			
	J21-4525-04	MOUNTING HARDWARE			
	J25-5080-23	PCB (UNMOUNTED)			
	N09-0718-05	SCREW			
	N19-0191-05	WASHER NONMETAL			
	N30-3008-46	SCREW, PAN HD M 3X8			
	212-7004-05	TUBE (PLASTIC)			
	420-0008-05	ADHESIVES			
C003	CC45CH1H390J	CAP. CERAMIC	39P	5%	50V
C008	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C009	CC45CH1H100D	CAP. CERAMIC.	10P	0.5P	50V
C010	CC45CH1H040C	CAP. CERAMIC	4P	0.25P	50V
C011	NO USE				
C012	CE04BW1H470M	CAP. ELECTRO	47	20%	50V
C015	CC45CH1H390J	CAP. CERAMIC	39P	5%	50V
C020	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C021	CC45CH1H040C	CAP. CERAMIC	4P	0.25P	50V
C026	CC45CH1H050C	CAP. CERAMIC	5P	0.25P	50V
C027	CC45CH1H150J	CAP. CERAMIC	15P	5%	50V
C028	CC45CH2H010C	CAP. CERAMIC	1P	0.25%	500V
C029	CC45CH2H010C	CAP. CERAMIC	1P	0.25%	500V
C030	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C033	CK45B2H332K	CAP. CERAMIC	3300P	10%	500V
C034	CK45B2H332K	CAP. CERAMIC	3300P	10%	500V
C035	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C042	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C043	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C044	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C045	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C046	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C047	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C048	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C049	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C050	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C051	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C052	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C053	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C054	NO USE				
C055	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C056	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C057	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C058	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C059	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C060	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C061	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C062	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C063	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C064	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C065	NO USE				
C066	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C067	NO USE				
C068	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C069	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C070	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C071	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C072	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C073	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C074	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C075	CE04W2C220	CAP. ELECTRO	22		160V
C076	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C077	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C078	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C079	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C080	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C081	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C082	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C083	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C084	NO USE				
C085	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C086	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C087	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C088	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C089	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C090	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C091	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C092	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C093	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C094	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C095	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C096	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C097	CE04W1C221M	CAP. ELECTRO	220	20%	16V
C098	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C099	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C100	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C101	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C102	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C103	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C104	NO USE				
C105	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C106	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C107	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C108	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C109	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C110	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C111	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C112	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C113	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C114	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C115	NO USE				
C116	CE04W1A221M	CAP. ELECTRO	220	20%	10V
C117	CE04W1A221M	CAP. ELECTRO	220	20%	10V
C118	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C119	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C120	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C121	CC45CH1H150J	CAP. CERAMIC	15P	5%	50V
C122	CC45CH1H121J	CAP. CERAMIC	120P	5%	50V
C123	CC45CH1H270J	CAP. CERAMIC	27P	5%	50V
C124	NO USE				
C125	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
C126	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
C127	CC45SL1H220J	CAP. CERAMIC	22P	5%	50V
C128	CC45SL1H220J	CAP. CERAMIC	22P	5%	50V
C129	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C130	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C131	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C132	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C133	NO USE				
C134	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C135	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C136	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C139	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C140	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C141	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C142	CC45CH1H390J	CAP. CERAMIC	39P	5%	50V
C143	CC45CH1H330J	CAP. CERAMIC	33P	5%	50V
C144	CC45CH1H070D	CAP. CERAMIC	7P	0.5P	50V
C145	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C146	CE04W1C330M	CAP. ELECTRO	33	20%	16V
C147	CC45CH1H070D	CAP. CERAMIC	7P	0.5P	50V
C148	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C149	CE04W1C330M	CAP. ELECTRO	33	20%	16V
C150	CC45SL1H220J	CAP. CERAMIC	22P	5%	50V
C151	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C152	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C153	CC45CH1H181J	CAP. CERAMIC	180P	5%	50V
C154	CE04W1E101M	CAP. ELECTRO	100	20%	25V
C155	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SS132	DIODE			
D005	1SS132	DIODE			
D006	1SS132	DIODE			
D007	MTZ5.1JB	DIODE ZENER	5V		
D014	MTZ10JC	DIODE, ZENER	10V		
D015	MTZ10JC	DIODE, ZENER	10V		
D016	1SS132	DIODE			
D017	1SS132	DIODE			
D018	MTZ10JC	DIODE, ZENER	10V		
D019	1SS132	DIODE			
D020	1SS132	DIODE			
D021	1SS132	DIODE			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
D022	1SS132	DIODE			
D023	MTZ8.2JB	DIODE, ZENER	8.1V		
L004	L40-1011-04	FERRI INDUCTOR	100UH		
L005	L40-1011-04	FERRI INDUCTOR	100UH		
L006	L40-1011-04	FERRI INDUCTOR	100UH		
L007	L40-1011-04	FERRI INDUCTOR	100UH		
P001	E40-0873-05	PIN CONNECTOR	8 P		
P002	E40-0373-05	PIN CONNECTOR	3 P		
P003	E40-0373-05	PIN CONNECTOR	3 P		
P004	E40-0373-05	PIN CONNECTOR	3 P		
P005	E40-0373-05	PIN CONNECTOR	3 P		
P006	E40-0273-05	PIN CONNECTOR	2 P		
P007	E40-0273-05	PIN CONNECTOR	2 P		
P008	E40-0273-05	PIN CONNECTOR	2 P		
P009	E40-0273-05	PIN CONNECTOR	2 P		
P010	E40-0273-05	PIN CONNECTOR	2 P		
P011	E40-0911-05	PIN CONNECTOR	9P		
P012	E40-0373-05	PIN CONNECTOR	3 P		
P013	E40-0373-05	PIN CONNECTOR	3 P		
P014	E40-0273-05	PIN CONNECTOR	2 P		
P015	E40-0273-05	PIN CONNECTOR	2 P		
P016	E40-0873-05	PIN CONNECTOR	8 P		
P017	E40-0273-05	PIN CONNECTOR	2 P		
P018	E40-0273-05	PIN CONNECTOR	2 P		
P019	E40-0673-05	PIN CONNECTOR	6 P		
P020	E40-0373-05	PIN CONNECTOR	3 P		
P021	E40-0673-05	PIN CONNECTOR	6 P		
P047	E40-0473-05	PIN CONNECTOR	4 P		
P072	E40-0273-05	PIN CONNECTOR	2 P		
Q001	2SC3066(F,G)	TR. SI, NPN			
Q002	2SC3315(C,D)	TR. SI, NPN			
Q003	2SC3066(F,G)	TR. SI, NPN			
Q004	2SA1323(B,C)	TR. SI, PNP			
Q005	2SA1323(B,C)	TR. SI, PNP			
Q006	2SC3315(C,D)	TR. SI, NPN			
Q007	2SC3315(C,D)	TR. SI, NPN			
Q008	2SC3315(C,D)	TR. SI, NPN			
Q009	2SA1323(B,C)	TR. SI, PNP			
Q010	2SA1323(B,C)	TR. SI, PNP			
Q011	2SC3315(C,D)	TR. SI, NPN			
Q012	2SC3315(C,D)	TR. SI, NPN			
Q013	2SA1323(B,C)	TR. SI, PNP			
Q014	2SA1323(B,C)	TR. SI, PNP			
Q015	2SA1323(B,C)	TR. SI, PNP			
Q016	2SA1323(B,C)	TR. SI, PNP			
Q017	2SC3315(C,D)	TR. SI, NPN			
Q018	2SA1323(B,C)	TR. SI, PNP			
Q019	2SC3066(F,G)	TR. SI, NPN			
Q020	2SC3315(C,D)	TR. SI, NPN			
Q021	2SC3066(F,G)	TR. SI, NPN			
Q022	2SA1323(B,C)	TR. SI, PNP			
Q023	2SA1323(B,C)	TR. SI, PNP			
Q024	2SA1323(B,C)	TR. SI, PNP			
Q025	2SA1323(B,C)	TR. SI, PNP			
Q026	2SC3315(C,D)	TR. SI, NPN			
Q027	2SC3315(C,D)	TR. SI, NPN			
Q028	2SC3315(C,D)	TR. SI, NPN			
Q029	2SA1323(B,C)	TR. SI, PNP			
Q030	2SA1323(B,C)	TR. SI, PNP			
Q031	2SC3315(C,D)	TR. SI, NPN			
Q032	2SC3315(C,D)	TR. SI, NPN			
Q033	2SA1323(B,C)	TR. SI, PNP			
Q034	2SA1323(B,C)	TR. SI, PNP			
Q035	2SA1323(B,C)	TR. SI, PNP			
Q036	2SC3315(C,D)	TR. SI, NPN			
Q037	2SC3315(C,D)	TR. SI, NPN			
Q038	2SC3315(C,D)	TR. SI, NPN			
Q039	2SC3315(C,D)	TR. SI, NPN			
Q040	2SA1323(B,C)	TR. SI, PNP			
Q041	2SC3315(C,D)	TR. SI, NPN			
Q042	2SC3315(C,D)	TR. SI, NPN			
Q043	2SC2786(K)	TR. SI, NPN			
Q044	2SC2786(K)	TR. SI, NPN			
Q045	2SC2786(K)	TR. SI, NPN			
Q046	2SC2786(K)	TR. SI, NPN			
Q047	2SC1973(T)	TR. SI, NPN			
Q048	2SC1973(T)	TR. SI, NPN			
Q049	2SC2912(S)	TR. SI, NPN			
Q050	2SC2912(S)	TR. SI, NPN			
Q051	2SA1210(S)	TR. SI, PNP			
Q052	2SA1210(S)	TR. SI, PNP			
Q053	2SC1973(T)	TR. SI, NPN			
Q054	2SC1973(T)	TR. SI, NPN			
Q055	2SA1323(B,C)	TR. SI, PNP			
Q056	2SA1323(B,C)	TR. SI, PNP			
Q057	2SA1323(B,C)	TR. SI, PNP			
Q058	2SA1323(B,C)	TR. SI, PNP			
Q059	2SC3315(C,D)	TR. SI, NPN			
Q060	2SC3315(C,D)	TR. SI, NPN			
Q061	2SC3315(C,D)	TR. SI, NPN			
Q062	2SC3315(C,D)	TR. SI, NPN			
Q063	2SC3315(C,D)	TR. SI, NPN			
Q064	2SC3315(C,D)	TR. SI, NPN			
Q065	2SC3315(C,D)	TR. SI, NPN			
Q066	2SC3315(C,D)	TR. SI, NPN			
Q067	NO USE				
Q068	2SC3311(Q,R)	TR. SI, NPN			
Q069	2SK30A(O)	FET,N-CHANNEL			
Q070	2SC3311(Q,R)	TR. SI, NPN			
R001	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R002	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R003	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R004	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R005	NO USE				
R006	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R007	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R008	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R009	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R010	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R011	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R012	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R013	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R014	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R015	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R016	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R017	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R018	NO USE				
R019	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R020	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R021	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R022	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R023	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R024	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R025	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R026	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R030	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R031	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R032	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R033	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R034	RN14BK2C1200F	RES. METAL FILM	120	1%	1/6W
R035	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R036	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R037	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R038	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R039	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R040	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R041	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R042	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R043	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R044	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R045	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R046	NO USE				
R047	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R048	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R049	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R050	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R051	RN14BK2C1800F	RES. METAL FILM	180	1%	1/6W
R052	RN14BK2C9100F	RES. METAL FILM	910	1%	1/6W
R053	RN14BK2C9100F	RES. METAL FILM	910	1%	1/6W
R054	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R055	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R056	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R057	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R058	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R059	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R060	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R061	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R062	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R063	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R064	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R065	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R066	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R067	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R068	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R069	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R070	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R071	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R072	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R073	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R074	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R075	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R076	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R077	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R078	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R079	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R080	RD14BB2C360J	RES. CARBON	36	5%	1/6W
R081	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R082	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R083	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R084	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R085	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R086	NO USE				
R087	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R088	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R089	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R090	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R091	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R092	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R093	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R094	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R095	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R096	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R097	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R098	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R099	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R100	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R101	NO USE				
R102	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R103	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R104	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R105	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R106	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R107	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R108	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R109	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R110	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R114	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R115	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R116	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R117	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R118	RN14BK2C1200F	RES. METAL FILM	120	1%	1/6W
R119	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R120	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R121	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R122	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R123	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R124	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R125	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R126	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R127	RN14BK2C6201F	RES. METAL FILM	6.2K	1%	1/6W
R128	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R129	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R130	RN14BK2C9100F	RES. METAL FILM	910	1%	1/6W
R131	RN14BK2C9100F	RES. METAL FILM	910	1%	1/6W
R132	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R133	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R134	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R135	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R136	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R137	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R138	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R139	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R140	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R141	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R142	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R143	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R144	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R145	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R146	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R147	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R148	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R149	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R150	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R151	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R152	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R153	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R154	RD14BB2C153J	RES. CARBON	15K	5%	1/6W

REF.NO	PARTS NO	NAME & DESCRIPTION			
R155	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R156	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R157	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R158	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R159	RD14BB2C912J	RES. CARBON	9.1K	5%	1/6W
R160	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R161	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R162	RD14BB2C912J	RES. CARBON	9.1K	5%	1/6W
R163	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R164	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R165	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R166	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R167	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R168	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R169	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R170	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R171	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R172	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R173	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R174	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R175	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R176	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R177	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R180	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R181	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R182	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R183	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R184	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R185	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R186	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R187	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R188	NO USE				
R189	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R190	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R191	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R192	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R193	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R194	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R195	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R196	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R197	RN14BK2H6802F	RES. METAL FILM	68K	1%	1/2W
R198	RN14BK2H6802F	RES. METAL FILM	68K	1%	1/2W
R199	RD14BY2H333J	RES. CARBON	33K	5%	1/2W
R200	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R201	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R202	RD14BB2E752J	RES. CARBON	7.5K	5%	1/4W
R203	RD14BY2H102J	RES. CARBON	1K	5%	1/2W
R204	NO USE				
R205	RD14BY2H102J	RES. CARBON	1K	5%	1/2W
R206	NO USE				
R207	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R208	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R209	RS14GB3D821J	RES. METAL FILM	820	5%	2W
R210	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R211	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R212	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R213	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R214	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R215	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R216	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R217	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R218	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R219	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R220	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R221	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R222	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R223	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R224	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R225	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R226	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R227	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R228	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R229	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R230	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R231	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R232	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R233	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R234	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R235	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R236	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R237	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R238	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R239	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R240	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R241	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R242	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R243	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R244	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R245	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R246	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R247	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R248	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R249	RN14BK2C3301F	RES. METAL FILM 3.3K 1% 1/6W
R250	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R251	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W
R252	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R253	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R254	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R255	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R256	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R257	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R258	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R259	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R260	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R261	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R262	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R263	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R264	R90-0622-05	RES. NETWORK
R265	RN14BK2C3601F	RES. METAL FILM 3.6K 1% 1/6W
R266	RN14BK2C3601F	RES. METAL FILM 3.6K 1% 1/6W
R267	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R268	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R269	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R270	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R271	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R272	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R273	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R274	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R275	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R276	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R279	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R280	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R283	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R284	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R285	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R286	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R287	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R288	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R289	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R290	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R291	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R292	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R293	RD14BB2C162J	RES. CARBON 1.6K 5% 1/6W
R294	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R295	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R296	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R297	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R298	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R299	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R300	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R301	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R302	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R303	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R304	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R305	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R306	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R307	NO USE	
R308	RN14BK2C51R0F	RES. METAL FILM 51.0 1% 1/6W
R309	RN14BK2C30R0F	RES. METAL FILM 30.0 1% 1/6W
R310	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R313	RN14BK2C51R0F	RES. METAL FILM 51.0 1% 1/6W
R314	RN14BK2C30R0F	RES. METAL FILM 30.0 1% 1/6W
R315	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R316	NO USE	
R317	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R318	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R321	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R322	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R323	RD14BB2C203J	RES. CARBON 20K 5% 1/6W
R324	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R325	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
R326	RD14BB2C203J	RES. CARBON 20K 5% 1/6W
R327	NO USE	
R328	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R329	RD14BB2C102J	RES. CARBON 1K 5% 1/6W

REF.NO	PARTS NO	NAME & DESCRIPTION
R330	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R331	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R332	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R333	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R334	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R335	RD14BB2C560J	RES. CARBON 56 5% 1/6W
R336	RD14BB2C560J	RES. CARBON 56 5% 1/6W
R337	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R338	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W
R339	RD14BB2C911J	RES. CARBON 910 5% 1/6W
R340	RD14BB2C911J	RES. CARBON 910 5% 1/6W
R341	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R342	RD14BB2C911J	RES. CARBON 910 5% 1/6W
R343	RD14BB2C911J	RES. CARBON 910 5% 1/6W
R344	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R345	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
R346	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W
R347	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R348	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
TC001	C05-0412-05	CAP. TRIMMER 20P
TC002	C05-0410-05	CAP. TRIMMER 6P
TC003	C05-0412-05	CAP. TRIMMER 20P
TC004	C05-0411-05	CAP. TRIMMER 10P
TC005	C05-0412-05	CAP. TRIMMER 20P
TC006	C05-0411-05	CAP. TRIMMER 10P
TH001	SDT100	THERMISTOR
TH002	SDT100	THERMISTOR
TH003	SDT20	THERMISTOR
TH004	SDT100	THERMISTOR
TH005	SDT1000	THERMISTOR
TH006	SDT1000	THERMISTOR
TH007	SDT20	THERMISTOR
TP001	E40-0211-05	PIN CONNECTOR 2 P
U001	MC14584BCP	IC
U002	SN74LS04N	IC
U003	SN74LS11N	IC
U004	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U005	SN74LS51N	IC
U006	SN74LS51N	IC
U007	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U008	SN74LS32N	IC, QUAD 2-INPUT OR GATE
U009	SN74LS112AN	IC, DUAL JK-FF
U010	SN74LS157N	IC
U011	CA3102E	IC
U012	CA3102E	IC
U013	CA3102E	IC
U014	CA3102E	IC
U015	MC78M05CT	VOLTAGE REGULATOR (5V, 100MA)
VR001	R12-1533-05	RES. SEMI FIXED 1K B
VR002	NO USE	
VR003	R12-1534-05	RES. SEMI FIXED 2K B
VR004	R12-0565-05	RES. SEMI FIXED 100 B
VR005	R12-0565-05	RES. SEMI FIXED 100 B
VR006	R12-1534-05	RES. SEMI FIXED 2K B
VR007	R12-0567-05	RES. SEMI FIXED 500 B
VR008	R12-1533-05	RES. SEMI FIXED 1K B
VR009	R12-1533-05	RES. SEMI FIXED 1K B
VR010	NO USE	
VR011	R12-1534-05	RES. SEMI FIXED 2K B
VR012	R12-1534-05	RES. SEMI FIXED 2K B
VR013	NO USE	
VR014	R12-0565-05	RES. SEMI FIXED 100 B
VR015	R12-0565-05	RES. SEMI FIXED 100 B
VR016	R12-1534-05	RES. SEMI FIXED 2K B
VR017	R12-0567-05	RES. SEMI FIXED 500 B
VR018	NO USE	
VR019	R12-1533-05	RES. SEMI FIXED 1K B
VR020	R12-1533-05	RES. SEMI FIXED 1K B
VR021	R12-0567-05	RES. SEMI FIXED 500 B
VR022	R12-0567-05	RES. SEMI FIXED 500 B
VR023	R12-0567-05	RES. SEMI FIXED 500 B
VR024	R12-0567-05	RES. SEMI FIXED 500 B
VR025	R12-0567-05	RES. SEMI FIXED 500 B
VR026	R12-0567-05	RES. SEMI FIXED 500 B

PARTS LIST

SWEEP UNIT

X74-1400-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	A22-0845-04	SUB PANEL			
	E23-0503-05	TERMINAL			
	E33-4090-00	WIRE ASSY			
	J25-5081-22	PCB (UNMOUNTED)			
	N32-3006-41	SCREW, FLAT HD	M 3X6		
C001	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C002	CQ93M1H102K	CAP. MYLAR	1000P	10%	50V
C003	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C004	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C005	NO USE				
C006	CC45CH1H470J	CAP. CERAMIC	47P	5%	50V
C009	CE04W1H3R3M	CAP. ELECTRO	3.3	20%	50V
C010	CE04W1H3R3M	CAP. ELECTRO	3.3	20%	50V
C011	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C012	NO USE				
C013	C91-0548-05	CAP. METALIZED POLYESTER			
C014	CQ93BP2A103F	CAP. MYLAR	0.01	1%	100V
C015	CM93BD2A680J	CAP. MICA	68P	5%	100V
C016	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C017	CQ93BP2A103F	CAP. MYLAR	0.01	1%	100V
C018	CC45CH1H270J	CAP. CERAMIC	27P	5%	50V
C019	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C020	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C021	CE04W1E100M	CAP. ELECTRO	10	20%	25V
C022	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C023	CK45B1H472K	CAP. CERAMIC	4700P	10%	50V
C024	CK45B1H222K	CAP. CERAMIC	2200P	10%	50V
C025	CM93BD2A331J	CAP. MICA	330P	5%	100V
C026	CM93BD2A331J	CAP. MICA	330P	5%	100V
C027	CC45CH1H181J	CAP. CERAMIC	180P	5%	50V
C028	CC45CH1H221J	CAP. CERAMIC	220P	5%	50V
C029	CC45CH1H330J	CAP. CERAMIC	33P	5%	50V
C030	CC45CH1H330J	CAP. CERAMIC	33P	5%	50V
C031	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C032	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C033	CQ93BP2A472F	CAP. MYLAR	4700P	1%	100V
C034	CQ93BP2A472F	CAP. MYLAR	4700P	1%	100V
C035	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C036	CC45CH1H560J	CAP. CERAMIC	56P	5%	50V
C037	CC45CH1H020C	CAP. CERAMIC	2P	0.25P	50V
C038	NO USE				
C039	CQ93M1H332K	CAP. MYLAR	3300P	10%	50V
C043	CE04W2C220	CAP. ELECTRO	22		160V
C044	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C045	CE04W2C220	CAP. ELECTRO	22		160V
C046	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C047	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C048	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C049	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C050	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C051	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C052	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C053	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C054	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C055	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C056	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C057	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C058	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C059	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C060	CE04W1C471M	CAP. ELECTRO	470	20%	16V
C061	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C062	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C063	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C064	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C065	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C066	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C067	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C068	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C069	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C070	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C071	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C072	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C073	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C074	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C075	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C076	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C077	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C078	NO USE				
C079	CC45CH1H270J	CAP. CERAMIC	27P	5%	50V

REF.NO	PARTS NO	NAME & DESCRIPTION			
C080	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C081	CE04W1A470M	CAP. ELECTRO	47	20%	10V
C082	CE04W1A470M	CAP. ELECTRO	47	20%	10V
C083	CE04W1C471M	CAP. ELECTRO	470	20%	16V
C084	NO USE				
C085	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C086	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C087	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C088	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C089	CK45B1H102K	CAP. CERAMIC	1000P	10%	.50V
C090	NO USE				
C091	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C092	CC45CH1H050C	CAP. CERAMIC	5P	0.25P	50V
C093	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
D001	1SS135	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SS132	DIODE			
D005	LN322GP	DIODE			
D006	1SS132	DIODE			
D007	1SS132	DIODE			
D008	1SS132	DIODE			
D009	1SS132	DIODE			
D010	1SS132	DIODE			
D011	1SS132	DIODE			
D012	1SS132	DIODE			
D013	1SS132	DIODE			
D014	1SS132	DIODE			
D015	1SS132	DIODE			
D016	1SS132	DIODE			
D017	1SS132	DIODE			
D018	MTZ6.2JB	DIODE ZENER	6.1V		
D019	1N60	DIODE			
D020	1SS132	DIODE			
D021	1SS132	DIODE			
D022	MTZ3.3JA	DIODE, ZENER	3.2V		
D023	MTZ6.2JB	DIODE ZENER	6.1V		
D024	1SS132	DIODE			
D025	1N60	DIODE			
D026	1SS132	DIODE			
D027	1SS132	DIODE			
JP003	R92-0150-05	JUMPING RES.	ZERO OHM		
L001	L40-1011-04	FERRI INDUCTOR	100UH		
L002	L40-1011-04	FERRI INDUCTOR	100UH		
L003	L40-1011-04	FERRI INDUCTOR	100UH		
L004	L40-1011-04	FERRI INDUCTOR	100UH		
L005	NO USE				
L006	L40-1011-04	FERRI INDUCTOR	100UH		
L007	L40-1011-04	FERRI INDUCTOR	100UH		
P017	E40-0273-05	PIN CONNECTOR	2 P		
P018	E40-0273-05	PIN CONNECTOR	2 P		
P019	E40-0673-05	PIN CONNECTOR	6 P		
P020	E40-0373-05	PIN CONNECTOR	3 P		
P024	E40-0273-05	PIN CONNECTOR	2 P		
P025	E40-0273-05	PIN CONNECTOR	2 P		
P026	E40-0273-05	PIN CONNECTOR	2 P		
P027	E40-0373-05	PIN CONNECTOR	3 P		
P028	E40-0273-05	PIN CONNECTOR	2 P		
P029	E40-0373-05	PIN CONNECTOR	3 P		
P030	E40-0273-05	PIN CONNECTOR	2 P		
P031	E40-0273-05	PIN CONNECTOR	2 P		
P032	E40-0573-05	PIN CONNECTOR	5 P		
P033	E40-0473-05	PIN CONNECTOR	4 P		
P034	E40-0573-05	PIN CONNECTOR	5 P		
P066	E40-0216-05	PIN CONNECTOR	2 P		
P071	E40-0273-05	PIN CONNECTOR	2 P		
Q001	2SK30A(O)	FET,N-CHANNEL			
Q002	2SK30A(O)	FET,N-CHANNEL			
Q003	2SC3315(C,D)	TR. SI, NPN			
Q004	2SC3315(C,D)	TR. SI, NPN			
Q005	2SC3311(Q,R)	TR. SI, NPN			
Q006	2SA1323(B,C)	TR. SI, PNP			
Q007	2SA1323(B,C)	TR. SI, PNP			
Q008	2SC3311(Q,R)	TR. SI, NPN			
Q009	2SC3311(Q,R)	TR. SI, NPN			
Q010	2SA1323(B,C)	TR. SI, PNP			
Q011	2SK30A(O)	FET,N-CHANNEL			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
Q012	2SC3311(Q,R)	TR. SI, NPN			
Q013	2SA1323(B,C)	TR. SI, PNP			
Q014	2SK30A(O)	FET,N-CHANNEL			
Q015	2SC3311(Q,R)	TR. SI, NPN			
Q016	2SC3311(Q,R)	TR. SI, NPN			
Q017	2SC3311(Q,R)	TR. SI, NPN			
Q018	2SA1323(B,C)	TR. SI, PNP			
Q019	2SA1323(B,C)	TR. SI, PNP			
Q020	2SA1323(B,C)	TR. SI, PNP			
Q021	2SA1323(B,C)	TR. SI, PNP			
Q022	2SC2591(Q)	TR. SI, NPN			
Q023	2SA1323(B,C)	TR. SI, PNP			
Q024	2SC3311(Q,R)	TR. SI, NPN			
Q025	2SC3311(Q,R)	TR. SI, NPN			
Q026	2SC3311(Q,R)	TR. SI, NPN			
Q027	2SA1323(B,C)	TR. SI, PNP			
Q028	2SC3311(Q,R)	TR. SI, NPN			
Q029	2SC3311(Q,R)	TR. SI, NPN			
Q030	2SA1323(B,C)	TR. SI, PNP			
Q031	2SA1323(B,C)	TR. SI, PNP			
Q032	2SA1323(B,C)	TR. SI, PNP			
Q033	2SA1323(B,C)	TR. SI, PNP			
Q034	2SA1323(B,C)	TR. SI, PNP			
Q035	2SC1384(R)	TR, SI, NPN			
Q036	2SA684(R)	TR. SI, PNP			
Q037	2SC3311(Q,R)	TR. SI, NPN			
Q038	2SC3311(Q,R)	TR. SI, NPN			
Q039	2SC3311(Q,R)	TR. SI, NPN			
Q040	2SC3311(Q,R)	TR. SI, NPN			
Q041	2SC3311(Q,R)	TR. SI, NPN			
Q042	2SC3315(C,D)	TR. SI, NPN			
Q043	2SC1973(T)	TR. SI, NPN			
Q044	2SC3311(Q,R)	TR. SI, NPN			
Q045	2SC3311(Q,R)	TR. SI, NPN			
Q046	2SC3311(Q,R)	TR. SI, NPN			
Q047	2SC3315(C,D)	TR. SI, NPN			
Q048	2SC1973(T)	TR. SI, NPN			
Q049	2SC1973(T)	TR. SI, NPN			
Q050	2SC3311(Q,R)	TR. SI, NPN			
Q051	2SC3311(Q,R)	TR. SI, NPN			
Q052	2SC3311(Q,R)	TR. SI, NPN			
R001	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R002	RN14BK2E1004F	RES. METAL FILM	1M	1%	1/4W
R003	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R004	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R005	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R006	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R007	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R008	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R009	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R010	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R011	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R012	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R013	RN14BK2C1102F	RES. METAL FILM	11K	1%	1/6W
R014	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R015	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R016	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R017	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R018	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R019	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R020	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R021	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R022	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R023	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R024	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R025	RD14BB2C112J	RES. CARBON	1.1K	5%	1/6W
R026	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R027	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R028	RD14BB2C112J	RES. CARBON	1.1K	5%	1/6W
R029	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R030	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R031	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R032	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R033	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R034	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R035	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R036	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R037	RD14BB2C183J	RES. CARBON	18K	5%	1/6W
R038	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R039	RD14BB2C121J	RES. CARBON	120	5%	1/6W
R040	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R041	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R042	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R043	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R044	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R045	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R046	RN14BK2E2002F	RES. METAL FILM	20K	1%	1/4W
R047	RN14BK2E3002F	RES. METAL FILM	30K	1%	1/4W
R048	RN14BK2E5002F	RES. METAL FILM	50K	1%	1/4W
R049	RN14BK2E1003F	RES. METAL FILM	100K	1%	1/4W
R050	RN14BK2E3003F	RES. METAL FILM	300K	1%	1/4W
R051	RN14BK2H5003F	RES. METAL FILM	500K	1%	1/2W
R052	RN14BK2H1004F	RES. METAL FILM	1M	1%	1/2W
R053	RN14BK2H3004F	RES. METAL FILM	3M	1%	1/2W
R054	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R055	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R056	RS14GB3D273J	RES. METAL FILM	27K	5%	2W
R057	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R058	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R059	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R060	RN14BK2C1503F	RES. METAL FILM	150K	1%	1/6W
R061	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R062	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R063	RS14GB3D273J	RES. METAL FILM	27K	5%	2W
R064	RN14BK2C1102F	RES. METAL FILM	11K	1%	1/6W
R065	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R066	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R067	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R068	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R069	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R070	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R071	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R072	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R073	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R074	RD14BB2C303J	RES. CARBON	30K	5%	1/6W
R075	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R076	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R077	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R078	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R079	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R080	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R081	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R082	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R083	RN14BK2C3901F	RES. METAL FILM	3.9K	1%	1/6W
R084	RN14BK2C3901F	RES. METAL FILM	3.9K	1%	1/6W
R085	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R086	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R087	RD14BY2H103J	RES. CARBON	10K	5%	1/2W
R088	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R089	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R090	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R091	RD14BB2C563J	RES. CARBON	56K	5%	1/6W
R092	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R093	RD14BB2C563J	RES. CARBON	56K	5%	1/6W
R094	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R095	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R096	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R097	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R098	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R099	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R100	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R101	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R102	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R103	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R104	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R105	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R106	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R107	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R108	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R109	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R110	RD14BB2C683J	RES. CARBON	68K	5%	1/6W
R111	RD14BB2C683J	RES. CARBON	68K	5%	1/6W
R112	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R113	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R114	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R115	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R116	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R117	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R118	RN14BK2C1203F	RES. METAL FILM	120K	1%	1/6W
R119	RN14BK2C1203F	RES. METAL FILM	120K	1%	1/6W
R120	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R123	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R124	NO USE				
R125	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R126	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R127	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R128	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R129	RD14BB2C102J	RES. CARBON	1K	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R130	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R131	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R132	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R133	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R134	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R135	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R136	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R137	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R138	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R139	RD14BB2C271J	RES. CARBON 270 5% 1/6W
R140	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R141	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R142	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R143	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R144	RD14BB2C203J	RES. CARBON 20K 5% 1/6W
R145	RD14BB2C153J	RES. CARBON 15K 5% 1/6W
R146	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R147	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R148	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R149	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R150	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R151	RD14BB2C242J	RES. CARBON 2.4K 5% 1/6W
R152	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
R153	RN14BK2C3301F	RES. METAL FILM 3.3K 1% 1/6W
R154	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R155	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R156	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
R157	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R158	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R159	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R160	NO USE	
R161	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R162	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R163	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R164	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R167	RN14BK2C1200F	RES. METAL FILM 120 1% 1/6W
R168	RN14BK2C1200F	RES. METAL FILM 120 1% 1/6W
R169	RN14BK2C1500F	RES. METAL FILM 150 1% 1/6W
R170	RN14BK2C3301F	RES. METAL FILM 3.3K 1% 1/6W
R171	RN14BK2C1801F	RES. METAL FILM 1.8K 1% 1/6W
R172	NO USE	
R173	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R174	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R175	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R176	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R177	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R180	RD14BB2C183J	RES. CARBON 18K 5% 1/6W
R181	RN14BK2C2202F	RES. METAL FILM 22K 1% 1/6W
R182	RN14BK2C1801F	RES. METAL FILM 1.8K 1% 1/6W
R183	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R184	RN14BK2C33R0F	RES. METAL FILM 33.0 1% 1/6W
S001	S37-2005-05	LEVER SWITCH
S002	S32-2012-05	LEVER SWITCH
S003	NO USE	
S004	S32-2013-05	SLIDE SWITCH
S005	S31-1501-05	SLIDE SWITCH
S006	S29-2510-15	ROTARY SWITCH
TC001	C05-0414-05	CAP. TRIMMER 40P
TH001	SDT100	THERMISTOR
TH002	SDT100	THERMISTOR
U001	SN74LS04N	IC
U002	SN74LS123N	IC
U003	SN74LS112AN	IC, DUAL JK-FF
U004	SN74LS132N	IC
U005	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U006	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U007	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U008	MC14051BCP	IC
U009	UA78M05UC	IC
U010	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
VR001	R01-4503-05	V.R. 50K B
VR002	R12-3540-05	RES. SEMI FIXED 10K B
VR003	R12-1534-05	RES. SEMI FIXED 2K B
VR006	R12-1533-05	RES. SEMI FIXED 1K B
VR007	R12-5525-05	RES. SEMI FIXED 100K B
VR008	R12-1534-05	RES. SEMI FIXED 2K B
VR009	R12-2519-05	RES. SEMI FIXED 5K B

REF.NO	PARTS NO	NAME & DESCRIPTION
VR010	R12-0542-05	RES. SEMI FIXED 200 B
VR011	R12-5525-05	RES. SEMI FIXED 100K B
VR012	R12-1533-05	RES. SEMI FIXED 1K B
VR013	R12-1534-05	RES. SEMI FIXED 2K B
VR014	R12-3541-05	RES. SEMI FIXED 20K B
VR015	R01-2504-05	V.R. 5K B
VR016	R12-3540-05	RES. SEMI FIXED 10K B
VR017	R12-2519-05	RES. SEMI FIXED 5K B
VR018	R12-1533-05	RES. SEMI FIXED 1K B
VR019	R12-0541-05	RES. SEMI FIXED 100 B
VR020	R12-0541-05	RES. SEMI FIXED 100 B

PARTS LIST

HORIZONTAL OUTPUT UNIT

X74-1410-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E23-0503-05	TERMINAL			
	F01-0846-05	HEAT SINK			
	N19-0191-05	WASHER NONMETAL			
	N30-3006-46	SCREW, PAN HD	M 3X6		
C001	CE04W1C221M	CAP. ELECTRO	220	20%	16V
C002	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C003	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C004	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C005	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C006	CE04W2C220	CAP. ELECTRO	22		160V
C007	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C008	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C009	CK45F1H103Z	CAP. CERAMIC	0.01		50V
D001	1SS83	DIODE			
D002	1SS83	DIODE			
J001	R92-0150-05	JUMPING RES.	ZERO OHM		
J002	R92-0150-05	JUMPING RES.	ZERO OHM		
J003	R92-0150-05	JUMPING RES.	ZERO OHM		
L001	L40-3311-03	FERRI INDUCTOR	330UH		
L002	L40-3311-03	FERRI INDUCTOR	330UH		
L003	L40-1011-04	FERRI INDUCTOR	100UH		
L004	L40-1011-04	FERRI INDUCTOR	100UH		
P034	E40-0573-05	PIN CONNECTOR	5 P		
Q001	2SC1505	TR. SI, NPN			
Q002	2SC1505	TR. SI, NPN			
R001	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R002	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R003	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R004	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R005	RS14GB3D682J	RES. METAL FILM	6.8K	5%	2W
R006	RS14GB3D682J	RES. METAL FILM	6.8K	5%	2W
R007	RD14BY2H391J	RES. CARBON	390	5%	1/2W
R008	RD14BY2H391J	RES. CARBON	390	5%	1/2W

VOLTAGE SELECTOR UNIT

X77-1020-03

REF.NO	PARTS NO	NAME & DESCRIPTION	
	E08-1081-05	VOLTAGE SELECTOR RECEPTACLE	
	E09-0681-05	VOLTAGE SELECTOR PLUG	
	E23-0047-04	TERMINAL	
	E40-0533-05	PIN CONNECTOR	
	E40-0635-05	PIN CONNECTOR	
	F19-0703-04	VOLTAGE SECECTOR PLATE	
	J12-0501-14	MOLDED PIN	
	J25-2805-14	PCB (UNMOUNTED)	
	R92-0150-05	JUMPING RES.	ZERO OHM

VERTICAL SWITCH UNIT

X77-1360-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	A22-0844-13	SUB PANEL			
	E04-0251-05	BNC RECEPTACLE			
	J61-0049-05	WIRE BAND			
	N32-3006-41	SCREW, FLAT HD	M 3X6		
	002-0001-05	BRAIDED WIRE			
	212-2014-05	TUBE (PLASTIC)			
C001	C91-0501-05	CAP. METAL FILM	0.047	10%	630V
C002	C91-0501-05	CAP. METAL FILM	0.047	10%	630V
J001	R92-0150-05	JUMPING RES.	ZERO OHM		
J002	R92-0150-05	JUMPING RES.	ZERO OHM		
P001	E40-0874-05	PIN CONNECTOR	8P		
P070	E40-0374-05	PIN CONNECTOR	3 P		
R001	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R002	RD14BB2E105J	RES. CARBON	1M	5%	1/4W
R003	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R004	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R005	RD14BB2E105J	RES. CARBON	1M	5%	1/4W
R006	RD14BB2C220J	RES. CARBON	22	5%	1/6W
S001	S32-4007-05	LEVER SWITCH			
S002	S32-4007-05	LEVER SWITCH			
S003	S42-6507-05	PUSH SWITCH			
S004	S40-2519-05	PUSH SWITCH			

CONTROL UNIT

X77-1330-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J11-0503-05	EJECTOR			
	J25-5054-32	PCB (UNMOUNTED)			
C001	CE04W1C221M	CAP. ELECTRO	220	20%	16V
C002	CS15E1V2R2M	CAP. TANTALUM	2.2	20%	35V
C003	CS15E1V2R2M	CAP. TANTALUM	2.2	20%	35V
C006	CS15E1V2R2M	CAP. TANTALUM	2.2	20%	35V
C007	CS15E1V2R2M	CAP. TANTALUM	2.2	20%	35V
C008	CS15E1V2R2M	CAP. TANTALUM	2.2	20%	35V
C009	CS15E1V2R2M	CAP. TANTALUM	2.2	20%	35V
C010	CS15E1V2R2M	CAP. TANTALUM	2.2	20%	35V
C011	CC45SL1H471J	CAP. CERAMIC	470P	5%	50V
C012	CE04W1C100M	CAP. ELECTRO	10	20%	16V
C013	CK45B1H103K	CAP. CERAMIC	0.01	10%	50V
C017	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C018	CE04W1C100M	CAP. ELECTRO	10	20%	16V
C019	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C020	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C021	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C022	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C023	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C024	CC45CH1H151J	CAP. CERAMIC	150P	5%	50V
C025	CE04W1C100M	CAP. ELECTRO	10	20%	16V
C026	CE04W1C220M	CAP. ELECTRO	22	20%	16V
C027	CC45CH1H181J	CAP. CERAMIC	180P	5%	50V
C028	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C029	NO USE				
C030	CC45SL1H391J	CAP. CERAMIC	390P	5%	50V
C031	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C032	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C033	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C034	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C035	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C036	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C037	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C038	CQ93M1H223K	CAP. MYLAR	0.022	10%	50V
C039	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C040	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C041	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C042	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C043	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C044	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C045	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C046	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C047	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C048	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C049	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C050	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C051	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C052	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C053	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C054	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C055	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C056	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C057	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C058	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C059	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C060	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C061	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C062	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C063	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C064	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C065	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C066	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C067	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C068	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C069	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C070	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C071	C90-0298-05	CAP. CERAMIC	0.1	20%	12V

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
C072	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C073	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C074	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C075	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C076	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C077	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C078	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C079	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C080	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C081	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C082	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C083	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C084	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C085	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C086	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C087	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C088	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C089	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C090	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C091	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C092	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C093	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C094	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C095	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C096	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C097	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C098	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C099	CC45SL1H391J	CAP. CERAMIC	390P	5%	50V
C100	CC45SL1H471J	CAP. CERAMIC	470P	5%	50V
C101	CC45SL1H391J	CAP. CERAMIC	390P	5%	50V
C102	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C103	CC45SL1H471J	CAP. CERAMIC	470P	5%	50V
C104	CC45SL1H471J	CAP. CERAMIC	470P	5%	50V
C105	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C106	CK45B1H103K	CAP. CERAMIC	0.01	10%	50V
C107	NO USE				
C108	CC45SL1H471J	CAP. CERAMIC	470P	5%	50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SS132	DIODE			
D005	1SS132	DIODE			
D006	1SS132	DIODE			
D007	1SS132	DIODE			
D008	1SS132	DIODE			
D009	1SS132	DIODE			
D010	1SS132	DIODE			
D011	1SS132	DIODE			
D012	1SS132	DIODE			
D013	1SS132	DIODE			
D014	1SS132	DIODE			
D015	1SS132	DIODE			
D016	1SS132	DIODE			
P001	E40-0273-05	PIN CONNECTOR	2 P		
P002	E40-0273-05	PIN CONNECTOR	2 P		
Q001	2SC1815(GR)	TR. SI, NPN			
R001	RN14BK2C1802F	RES. METAL FILM	18K	1%	1/6W
R002	NO USE				
R003	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R004	NO USE				
R005	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R006	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R007	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R008	RD14BB2C564J	RES. CARBON	560K	5%	1/6W
R009	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R010	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R011	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R012	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R013	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R014	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R015	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R016	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R017	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R018	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R019	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R020	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R021	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R022	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R023	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R024	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R025	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R026	RN14BK2C8202F	RES. METAL FILM	82K	1%	1/6W
R027	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R028	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R029	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R030	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R033	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R034	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R035	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R036	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R037	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R038	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R039	NO USE				
R040	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R041	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R042	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R043	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R044	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R045	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R046	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R047	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R048	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R049	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R050	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R051	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R052	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R053	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R054	NO USE				
R055	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R056	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R057	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R058	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R059	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R060	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R061	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R062	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R063	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R064	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R065	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
RA001	R90-0609-05	RES. NETWORK	4.7K		
RA002	R90-0609-05	RES. NETWORK	4.7K		
RA003	R90-0609-05	RES. NETWORK	4.7K		
U001	TC40H002P	IC			
U002	SN74LS00N	IC, QUAD 2-INPUT NAND GATE			
U003	SN74LS157N	IC			
U004	SN74LS00N	IC, QUAD 2-INPUT NAND GATE			
U005	SN74LS193N	IC			
U006	SN74LS193N	IC			
U007	SN74LS193N	IC			
U008	SN74LS04N	IC			
U009	SN74LS21N	IC			
U010	SN74LS86N	IC			
U011	LM556CN	IC			
U012	SN74LS157N	IC			
U013	SN74LS04N	IC			
U014	SN74LS193N	IC			
U015	SN74LS193N	IC			
U016	SN74LS193N	IC			
U017	SN74LS32N	IC, QUAD 2-INPUT OR GATE			
U018	SN74LS08N	IC, QUAD 2-INPUT AND GATE			
U019	SN74LS157N	IC			
U020	TC40H004P	IC			
U021	SN74LS32N	IC, QUAD 2-INPUT OR GATE			
U022	SN74LS51N	IC			
U023	SN74LS04N	IC			
U024	SN74LS682N	IC			
U025	SN74LS27N	IC			
U026	SN74LS20N	IC			
U027	SN74LS51N	IC			
U028	SN74LS27N	IC			
U029	SN74LS04N	IC			
U030	TC40H000P	IC			
U031	SN74LS279N	IC			
U032	SN74LS04N	IC			
U033	SN74LS08N	IC, QUAD 2-INPUT AND GATE			
U034	SN74LS30N	IC			
U035	SN74LS85N	IC			
U036	SN74LS193N	IC			
U037	SN74LS123N	IC			
U038	SN74LS00N	IC, QUAD 2-INPUT NAND GATE			
U039	SN74LS279N	IC			
U040	SN74LS00N	IC, QUAD 2-INPUT NAND GATE			
U041	SN74LS32N	IC, QUAD 2-INPUT OR GATE			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
U042	SN74LS157N	IC
U043	SN74LS02N	IC
U044	SN74LS193N	IC
U045	SN74LS193N	IC
U046	SN74LS107AN	IC
U047	SN74LS04N	IC
U048	SN74LS12N	IC
U049	SN74LS123N	IC
U050	SN74LS157N	IC
U051	SN74LS11N	IC
U052	SN74LS21N	IC
U053	SN74LS04N	IC
U054	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U055	SN74LS107AN	IC
U056	SN74LS51N	IC
U057	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U058	SN74LS132N	IC

MOTHER BOARD UNIT

X81-1440-01

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5055-12	PCB (UNMOUNTED)			
C001	C91-0590-05	CAP. CERAMIC	3P	0.25P	3KV
C002	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C003	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C004	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C005	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
D001	1SS132	DIODE			
J001	E10-0062-05	EDGE CARD CONNECTOR			
J002	E10-5662-05	EDGE CARD CONNECTOR			
J002	R92-1061-05	JUMPING RES.	ZERO OHM		
J003	E10-0062-05	EDGE CARD CONNECTOR			
J004	E10-5662-05	EDGE CARD CONNECTOR			
J005	E10-0062-05	EDGE CARD CONNECTOR			
J006	E10-5662-05	EDGE CARD CONNECTOR			
J007	E10-5662-05	EDGE CARD CONNECTOR			
P001	E10-2664-05	EDGE CARD CONNECTOR			
P002	E10-2061-05	EDGE CARD CONNECTOR			
P008	E40-0473-05	PIN CONNECTOR	4 P		
P004	E40-0673-05	PIN CONNECTOR	6 P		
P005	E40-0873-05	PIN CONNECTOR	8 P		
P006	E40-0473-05	PIN CONNECTOR	4 P		
P007	E40-0632-05	PIN CONNECTOR	6 P		
P008	E40-0273-05	PIN CONNECTOR	2 P		
P009	E40-0332-05	PIN CONNECTOR	3 P		
R001	RD14BB2E220J	RES. CARBON	22	5%	1/4W
U001	SN74LS74AN	IC			
U002	SN74LS32N	IC, QUAD 2-INPUT OR GATE			
U003	SN74LS00N	IC, QUAD 2-INPUT NAND GATE			
U004	SN74LS02N	IC			

REFRESH UNIT

X81-1450-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J11-0503-05	EJECTOR			
	J25-5056-22	PCB (UNMOUNTED)			
C001	CE04W1C221M	CAP. ELECTRO	220	20%	16V
C002	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C003	CC45SL1H101J	CAP. CERAMIC	100P	5%	50V
C004	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C005	CC45SL1H101J	CAP. CERAMIC	100P	5%	50V
C006	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C007	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C008	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C009	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C010	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C011	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C012	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C013	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C014	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C015	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C016	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C017	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C018	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C019	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C020	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C021	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C022	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C023	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C024	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C025	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C026	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C027	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C028	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C029	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C030	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C031	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C032	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C033	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C034	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C035	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C036	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C037	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C038	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C039	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C040	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C041	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C042	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C043	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C044	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C045	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C046	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C047	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C048	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C049	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C050	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C051	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C052	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C053	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C054	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C055	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C056	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C057	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C058	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C059	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C060	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C061	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C062	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C063	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C064	CS15E1V2R2M	CAP. TANTALUM	2.2	20%	35V
C065	CE04W1E220M	CAP. ELECTRO	22	20%	25V
C066	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C067	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C068	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C069	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C070	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
P001	E40-0273-05	PIN CONNECTOR	2 P		
P002	E40-0373-05	PIN CONNECTOR	3 P		
R001	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R002	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R003	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R004	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R005	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R006	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R007	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R008	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R009	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R010	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R011	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R012	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
RA001	R90-0609-05	RES. NETWORK	4.7K		
RA002	R90-0609-05	RES. NETWORK	4.7K		
RA003	R90-0609-05	RES. NETWORK	4.7K		
RA004	R90-0609-05	RES. NETWORK	4.7K		
RA005	R90-0609-05	RES. NETWORK	4.7K		
U001	SN74LS32N	IC, QUAD 2-INPUT OR GATE			
U002	SN74LS04N	IC			
U003	SN74LS74AN	IC			
U004	SN74LS684N	IC			
U005	SN74LS85N	IC			
U006	SN74LS04N	IC			
U007	SN74LS684N	IC			
U008	SN74LS85N	IC			
U009	SN74LS04N	IC			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
U010	SN74LS10N	IC, TRPLE 3-INPUT NAND GATE
U011	SN74LS74AN	IC
U012	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U013	SN74LS157N	IC
U014	SN74LS157N	IC
U015	SN74LS157N	IC
U016	SN74LS157N	IC
U017	SN74LS157N	IC
U018	SN74LS157N	IC
U019	SN74LS157N	IC
U020	SN74LS157N	IC
U021	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U022	SN74LS193N	IC
U023	SN74LS193N	IC
U024	SN74LS193N	IC
U025	SN74LS193N	IC
U026	SN74LS193N	IC
U027	SN74LS193N	IC
U028	SN74LS123N	IC
U029	SN74LS123N	IC
U030	SN74LS04N	IC
U031	SN74LS193N	IC
U032	SN74LS193N	IC
U033	SN74LS193N	IC
U034	SN74LS193N	IC
U035	SN74LS193N	IC
U036	SN74LS193N	IC
U037	SN74LS27N	IC
U038	MC74HC174N	IC
U039	MC74HC174N	IC
U040	SN74LS85N	IC
U041	MC74HC174N	IC
U042	MC74HC174N	IC
U043	SN74LS85N	IC
U044	SN74LS02N	IC
U045	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U046	SN74LS684N	IC
U047	SN74LS04N	IC
U048	SN74LS684N	IC
U049	SN74LS04N	IC
U050	SN74LS123N	IC
U051	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U052	SN74LS32N	IC, QUAD 2-INPUT OR GATE

MEMORY UNIT

X81-1460-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	F01-0847-05	HEAT SINK
	J11-0503-05	EJECTOR
	J25-5060-12	PCB (UNMOUNTED)
	N10-2030-46	NUT, HEX
	N16-0030-46	SPRING WASHER
	N30-3010-41	SCREW, PAN HD M 3X10
C001	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C002	CK45B1H103K	CAP. CERAMIC 0.01 10% 50V
C003	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C004	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C005	CM93BD2A331J	CAP. MICA 330P 5% 100V
C006	CM93BD2A681J	CAP. MICA 680P 5% 100V
C007	CM93BD2A151J	CAP. MICA 150P 5% 100V
C008	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V
C009	C91-0591-05	CAP. CERAMIC 0.22 50V
C010	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C011	CK45B1H472K	CAP. CERAMIC 4700P 10% 50V
C012	C91-0591-05	CAP. CERAMIC 0.22 50V
C013	C91-0591-05	CAP. CERAMIC 0.22 50V
C014	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C015	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C016	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C017	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C018	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C019	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C020	C91-0591-05	CAP. CERAMIC 0.22 50V
C021	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C022	CK45B1H103K	CAP. CERAMIC 0.01 10% 50V
C023	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C024	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C025	CM93BD2A331J	CAP. MICA 330P 5% 100V
C026	CM93BD2A681J	CAP. MICA 680P 5% 100V
C027	CM93BD2A151J	CAP. MICA 150P 5% 100V
C028	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V
C029	G91-0591-05	CAP. CERAMIC 0.22 50V

REF.NO	PARTS NO	NAME & DESCRIPTION
C030	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C031	C91-0591-05	CAP. CERAMIC 0.22 50V
C032	CK45B1H472K	CAP. CERAMIC 4700P 10% 50V
C033	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C034	C91-0591-05	CAP. CERAMIC 0.22 50V
C035	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C036	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C037	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C038	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C039	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C040	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C041	C91-0591-05	CAP. CERAMIC 0.22 50V
C042	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C043	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C044	C91-0591-05	CAP. CERAMIC 0.22 50V
C045	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C046	C91-0591-05	CAP. CERAMIC 0.22 50V
C047	CC45CH1H470J	CAP. CERAMIC 47P 5% 50V
C048	C91-0591-05	CAP. CERAMIC 0.22 50V
C049	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C050	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C051	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C052	NO USE	
C053	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V
C054	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C055	C91-0591-05	CAP. CERAMIC 0.22 50V
C056	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C057	NO USE	
C058	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C059	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C060	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C061	C91-0591-05	CAP. CERAMIC 0.22 50V
C062	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C063	C91-0591-05	CAP. CERAMIC 0.22 50V
C064	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C065	C91-0591-05	CAP. CERAMIC 0.22 50V
C066	CC45CH1H470J	CAP. CERAMIC 47P 5% 50V
C067	C91-0591-05	CAP. CERAMIC 0.22 50V
C068	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C069	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C070	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C071	C91-0591-05	CAP. CERAMIC 0.22 50V
C072	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V
C073	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C074	NO USE	
C075	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C076	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C077	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C078	C91-0591-05	CAP. CERAMIC 0.22 50V
C079	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C080	C91-0591-05	CAP. CERAMIC 0.22 50V
C081	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C082	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C083	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C084	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C085	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C086	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C087	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C088	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C089	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C090	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C091	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C092	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C093	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C094	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C095	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C096	CE04W1E101M	CAP. ELECTRO 100 20% 25V
C097	C91-0591-05	CAP. CERAMIC 0.22 50V
C098	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C099	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C100	C91-0591-05	CAP. CERAMIC 0.22 50V
C101	C91-0591-05	CAP. CERAMIC 0.22 50V
C102	CE04W1E101M	CAP. ELECTRO 100 20% 25V
C103	C91-0591-05	CAP. CERAMIC 0.22 50V
C104	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C105	C91-0591-05	CAP. CERAMIC 0.22 50V
C106	C91-0591-05	CAP. CERAMIC 0.22 50V
C107	C91-0591-05	CAP. CERAMIC 0.22 50V
C108	C91-0591-05	CAP. CERAMIC 0.22 50V
C109	C91-0591-05	CAP. CERAMIC 0.22 50V
C110	C91-0591-05	CAP. CERAMIC 0.22 50V
C111	C91-0591-05	CAP. CERAMIC 0.22 50V
C112	C91-0591-05	CAP. CERAMIC 0.22 50V
C113	C91-0591-05	CAP. CERAMIC 0.22 50V
C114	C91-0591-05	CAP. CERAMIC 0.22 50V

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
C115	C91-0591-05	CAP. CERAMIC	0.22		50V
C116	C91-0591-05	CAP. CERAMIC	0.22		50V
C117	C91-0591-05	CAP. CERAMIC	0.22		50V
C118	C91-0591-05	CAP. CERAMIC	0.22		50V
C119	C91-0591-05	CAP. CERAMIC	0.22		50V
C120	C91-0591-05	CAP. CERAMIC	0.22		50V
C121	C91-0591-05	CAP. CERAMIC	0.22		50V
C122	C91-0591-05	CAP. CERAMIC	0.22		50V
C123	C91-0591-05	CAP. CERAMIC	0.22		50V
C124	C91-0591-05	CAP. CERAMIC	0.22		50V
C125	C91-0591-05	CAP. CERAMIC	0.22		50V
C126	C91-0591-05	CAP. CERAMIC	0.22		50V
C127	C91-0591-05	CAP. CERAMIC	0.22		50V
C128	C91-0591-05	CAP. CERAMIC	0.22		50V
C129	C91-0591-05	CAP. CERAMIC	0.22		50V
C130	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C131	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C132	CQ93M1H153K	CAP. MYLAR	0.015	10%	50V
C133	CQ93M1H153K	CAP. MYLAR	0.015	10%	50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SS132	DIODE			
D005	1SS132	DIODE			
D006	1SS132	DIODE			
D007	1SS132	DIODE			
D008	1SS132	DIODE			
D009	1SS132	DIODE			
D010	9491AJ	DIODE, ZENER	1.22V		
D011	1SZ58	DIODE ,ZENER	6.5V		
L001	L40-1011-04	FERRI INDUCTOR	100UH		
P001	E40-0373-05	PIN CONNECTOR	3 P		
P002	E40-0373-05	PIN CONNECTOR	3 P		
P003	E40-0273-05	PIN CONNECTOR	2 P		
P004	E40-0273-05	PIN CONNECTOR	2 P		
P005	E40-0273-05	PIN CONNECTOR	2 P		
P006	E40-0273-05	PIN CONNECTOR	2 P		
P007	E40 0273-05	PIN CONNECTOR	2 P		
P008	E40-0273-05	PIN CONNECTOR	2 P		
Q001	2SA838(C)	TR. SI, PNP			
Q002	2SC1047(C)	TR. SI, NPN			
Q003	2SK117(GR)	FET. N-CHANNEL			
Q004	2SK117(GR)	FET. N-CHANNEL			
Q005	2SK117(GR)	FET. N-CHANNEL			
Q006	2SA1175(F)	TR. SI, PNP			
Q007	2SC2785(F)	TR. SI, NPN			
Q008	2SC1384(R)	TR, SI, NPN			
Q009	2SA684(R)	TR. SI, PNP			
Q010	2SK117(GR)	FET. N-CHANNEL			
Q011	2SA733(Q)	TR. SI, PNP			
Q012	2SK117(GR)	FET. N-CHANNEL			
Q013	2SA1175(F)	TR. SI, PNP			
Q014	2SC2785(F)	TR. SI, NPN			
Q015	2SC1384(R)	TR, SI, NPN			
Q016	2SA684(R)	TR. SI, PNP			
R001	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R002	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R003	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R004	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R005	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R006	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R007	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R008	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R009	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R010	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R011	RN14BK2C1500F	RES. METAL FILM	150	1%	1/6W
R012	RN14BK2C9100F	RES. METAL FILM	910	1%	1/6W
R013	RN14BK2C1301F	RES. METAL FILM	1.3K	1%	1/6W
R014	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R015	RN14BK2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R016	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R017	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R018	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R019	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R020	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R021	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R022	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R023	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R024	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R025	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R026	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R027	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R028	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R029	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R030	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R031	RN14BK2C1500F	RES. METAL FILM	150	1%	1/6W
R032	RN14BK2C1301F	RES. METAL FILM	1.3K	1%	1/6W
R033	RN14BK2C9100F	RES. METAL FILM	910	1%	1/6W
R034	RD14BB2E680J	RES. CARBON	68	5%	1/4W
R035	RD14BB2E680J	RES. CARBON	68	5%	1/4W
R036	RN14BK2C1202F	RES. METAL FILM	12K	1%	1/6W
R037	RN14BK2C2701F	RES. METAL FILM	2.7K	1%	1/6W
R038	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R039	RN14BK2C4703F	RES. METAL FILM	470K	1%	1/6W
R040	RN14BK2C1202F	RES. METAL FILM	12K	1%	1/6W
R041	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R042	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R043	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R044	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R045	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R046	RN14BK2C2701F	RES. METAL FILM	2.7K	1%	1/6W
R047	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R048	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R049	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R050	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R051	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R052	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R053	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R054	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R055	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R056	RN14BK2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R057	RN14BK2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R058	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R059	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R060	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R061	RN14BK2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R062	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R063	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R064	RN14BK2C1202F	RES. METAL FILM	12K	1%	1/6W
R065	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R066	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R067	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R068	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R069	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R070	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R071	RN14BK2C2701F	RES. METAL FILM	2.7K	1%	1/6W
R072	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R073	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R074	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R075	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R076	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R077	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R078	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R079	RN14BK2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R080	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R081	RN14BK2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R082	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R083	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R084	RN14BK2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R085	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R086	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R087	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R088	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R089	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R090	RN14BK2C1202F	RES. METAL FILM	12K	1%	1/6W
R091	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R092	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R093	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R094	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R095	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R096	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R097	RN14BK2C9103F	RES. METAL FILM	910K	1%	1/6W
R098	RN14BK2C9103F	RES. METAL FILM	910K	1%	1/6W
R099	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
RA001	R90-0640-05				
RA002	R90-0640-05				
TP001	E23-0512 05	TERMINAL			
TP002	E23-0512-05	TERMINAL			
TP003	E23-0512-05	TERMINAL			
TP004	E23-0512-05	TERMINAL			
TP005	E23-0512-05	TERMINAL			
TP006	E23-0512-05	TERMINAL			
TP007	E23-0512-05	TERMINAL			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
TP008	E23-0512-05	TERMINAL
TP009	E23-0512-05	TERMINAL
TP010	E23-0512-05	TERMINAL
U001	LM318N	IC
U002	LM318N	IC
U003	LF411CN	IC, DUAL JFET INPUT OP-AMP
U004	LM318N	IC
U005	TDC1001J	IC
U006	LM318N	IC
U007	LM318N	IC
U008	LF411CN	IC, DUAL JFET INPUT OP-AMP
U009	LM318N	IC
U010	TDC1001J	IC
U011	SN74LS374N	IC, OCTAL 3S D-FFS
U012	SN74LS465N	IC
U013	SN74LS245N	IC
U014	SN74LS374N	IC, OCTAL 3S D-FFS
U015	SN74LS465N	IC
U016	SN74S112N	IC
U017	MB8416-20LP-GRA	IC
U018	MC14066BCP	IC
U019	MB8416-20LP-GRA	IC
U020	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U021	SN74LS273N	IC, OCTAL D-TYPE FLIP-FLOPS
U022	SN74LS245N	IC
U023	MB3761M	IC
U024	SN74LS273N	IC, OCTAL D-TYPE FLIP-FLOPS
U025	SN74LS245N	IC
U026	DAC08HP	IC, 8-BIT D/A CONVERTER
U027	LF412CN	IC, DUAL JFET INPUT OP-AMP
U028	LF411CN	IC, DUAL JFET INPUT OP-AMP
U029	DAC08HP	IC, 8-BIT D/A CONVERTER
U030	LF412CN	IC, DUAL JFET INPUT OP-AMP
U031	LF411CN	IC, DUAL JFET INPUT OP-AMP
U032	LM7905CT	REGULATOR
VR001	R12-1523-05	RES. SEMI FIXED 1K B
VR002	R12-0557-05	RES. SEMI FIXED 500 B
VR003	R12-0556-05	RES. SEMI FIXED 100 B
VR004	R12-1523-05	RES. SEMI FIXED 1K B
VR005	R12-1523-05	RES. SEMI FIXED 1K B
VR006	R12-0557-05	RES. SEMI FIXED 500 B
VR007	R12-0556-05	RES. SEMI FIXED 100 B
VR008	R12-1523-05	RES. SEMI FIXED 1K B
VR009	R12-1523-05	RES. SEMI FIXED 1K B
VR010	R12-1530-05	RES. SEMI FIXED 2K B
VR011	R12-1523-05	RES. SEMI FIXED 1K B
VR012	R12-3527-05	RES. SEMI FIXED 10K B
VR013	R12-0557-05	RES. SEMI FIXED 500 B
VR014	R12-1530-05	RES. SEMI FIXED 2K B
VR015	R12-1523-05	RES. SEMI FIXED 1K B
VR016	R12-1523-05	RES. SEMI FIXED 1K B
VR017	R12-1530-05	RES. SEMI FIXED 2K B
VR018	R12-1523-05	RES. SEMI FIXED 1K B
VR019	R12-3527-05	RES. SEMI FIXED 10K B
VR020	R12-0557-05	RES. SEMI FIXED 500 B
VR021	R12-1530-05	RES. SEMI FIXED 2K B

GP-IB UNIT

X81-1500-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E02-0135-15	SEMICONDUCTOR SOCKET			
	J25-5074-12	PCB (UNMOUNTED)			
C001	CE04W1E470M	CAP. ELECTRO	47	20%	25V
C002	CE04W1E470M	CAP. ELECTRO	47	20%	25V
C003	CE04W1E470M	CAP. ELECTRO	47	20%	25V
C004	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C005	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C006	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C007	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C008	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C009	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C010	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C011	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C012	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C013	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C014	CE04W1C100M	CAP. ELECTRO	10	20%	16V
D001	MTZ12JC	DIODE, ZENER	12V		
D002	MTZ12JC	DIODE, ZENER	12V		
D003	MTZ5.1JB	DIODE ZENER	5V		
D004	MTZ3.3JA	DIODE, ZENER	3.2V		
D005	1SS132	DIODE			
P002	E40-3485-05	PIN CONNECTOR			
P003	E40-0373-05	PIN CONNECTOR	3 P		
Q001	2SC945(P)	TR. SI, NPN			
Q002	2SC945(P)	TR. SI, NPN			
Q003	2SC945(P)	TR. SI, NPN			
Q004	2SC945(P)	TR. SI, NPN			
R001	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R002	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R003	RD14BB2E271J	RES. CARBON	270	5%	1/4W
R004	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R005	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R006	RD14BB2E271J	RES. CARBON	270	5%	1/4W
R007	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R008	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R009	RD14BB2E271J	RES. CARBON	270	5%	1/4W
R010	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R011	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R012	RD14BB2E472J	RES. CARBON	4.7K	5%	1/4W
R013	RD14BB2E101J	RES. CARBON	100	5%	1/4W
R014	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R015	RD14BB2E122J	RES. CARBON	1.2K	5%	1/4W
R016	RD14BB2E391J	RES. CARBON	390	5%	1/4W
R017	RD14BB2E472J	RES. CARBON	4.7K	5%	1/4W
R018	RD14BB2E271J	RES. CARBON	270	5%	1/4W
R019	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R020	RD14BB2E154J	RES. CARBON	150K	5%	1/4W
R021	RD14BB2E333J	RES. CARBON	33K	5%	1/4W
R022	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R023	RD14BB2E563J	RES. CARBON	56K	5%	1/4W
U001	TMP8155P	IC			
U002	SN74LS155N	IC			
U003	UPD8085AC	IC			
U004	SN74LS125AN	IC			
U005	UPD7210C	IC			
U006	SN75161AN	IC			
U007	SN75160AN	IC			
U008	MB8516ZC	IC			
U009	SN74LS373N	IC			
U010	NJM4558D	IC			
VR001	R12-1512-05	RES. SEMI FIXED 1K B			
X001	L78-0103-05	RESONATOR			

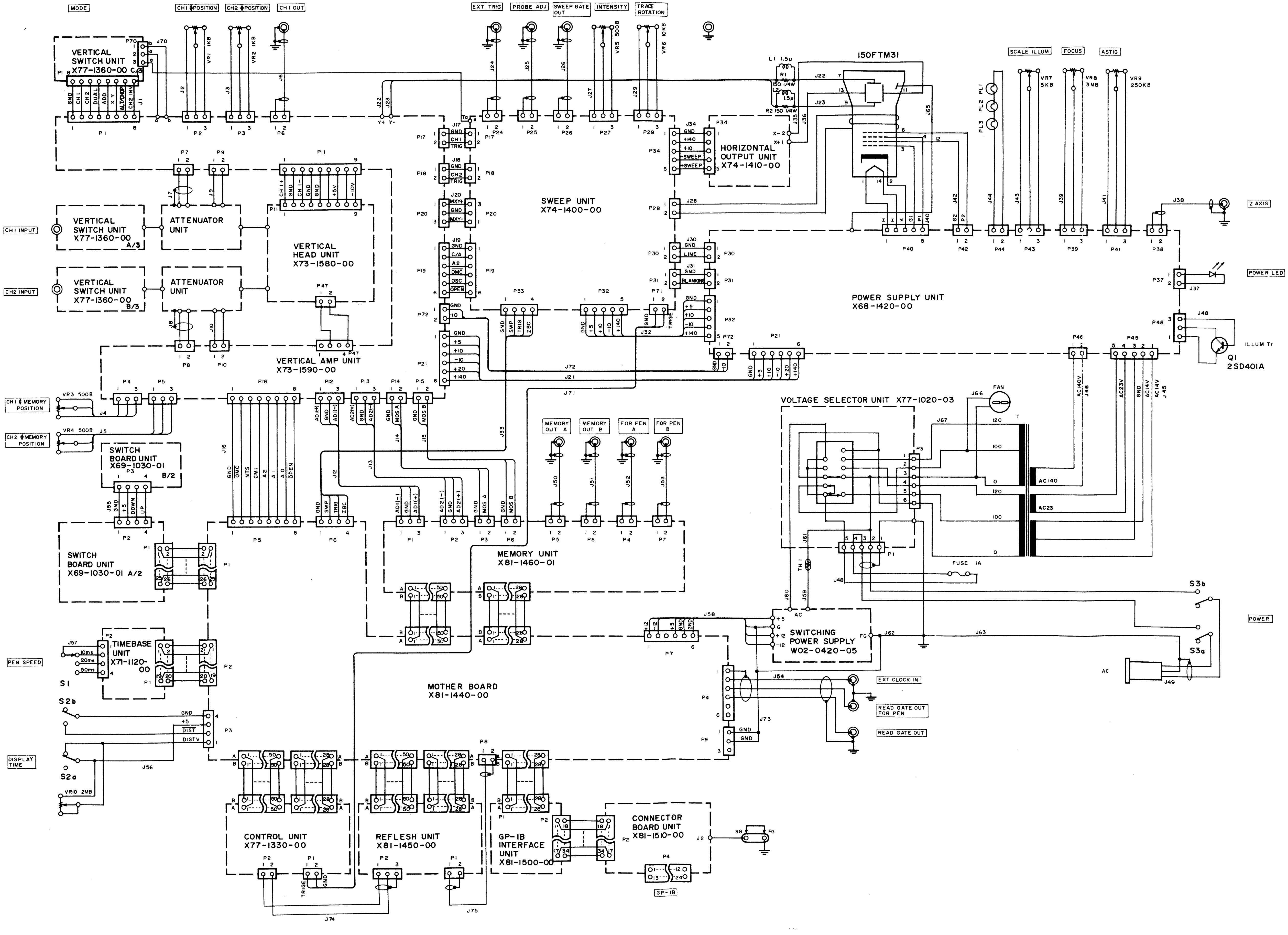
PARTS LIST

CONNECTOR UNIT

X81-1510-00

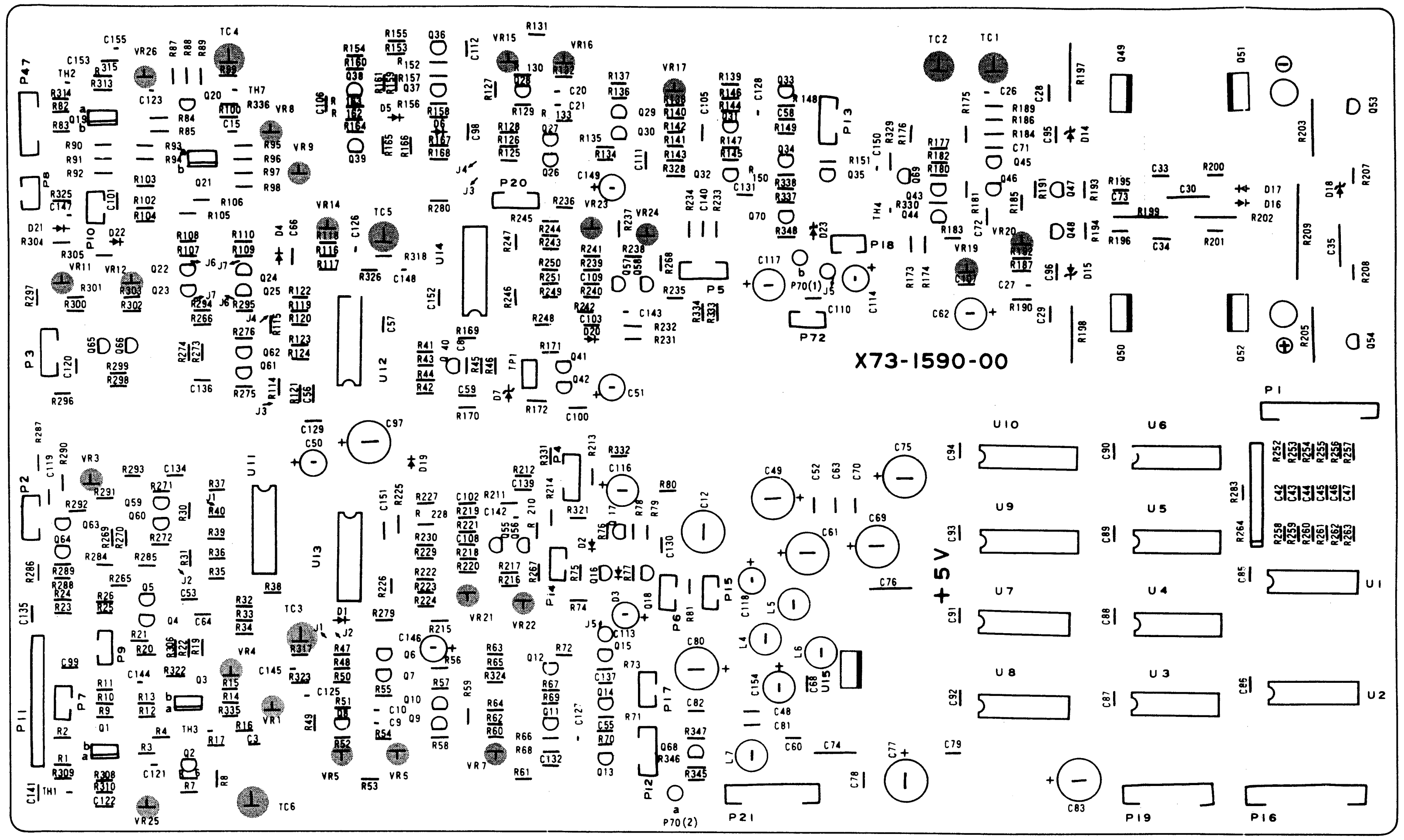
REF.NO	PARTS NO	NAME & DESCRIPTION	
	E08-2485-05	CONNECTOR	2 P
	E31-2543-05	LEAD WIRE WITH CONNECTOR	
	E33-4081-00	WIRE ASSY	
	J25-5075-03	PCB (UNMOUNTED)	
	N30-3006-46	SCREW, PAN HD	M 3X6
	R90-0609-05	RES. NETWORK	4.7K
	S31-8502-05	DIP SWITCH	

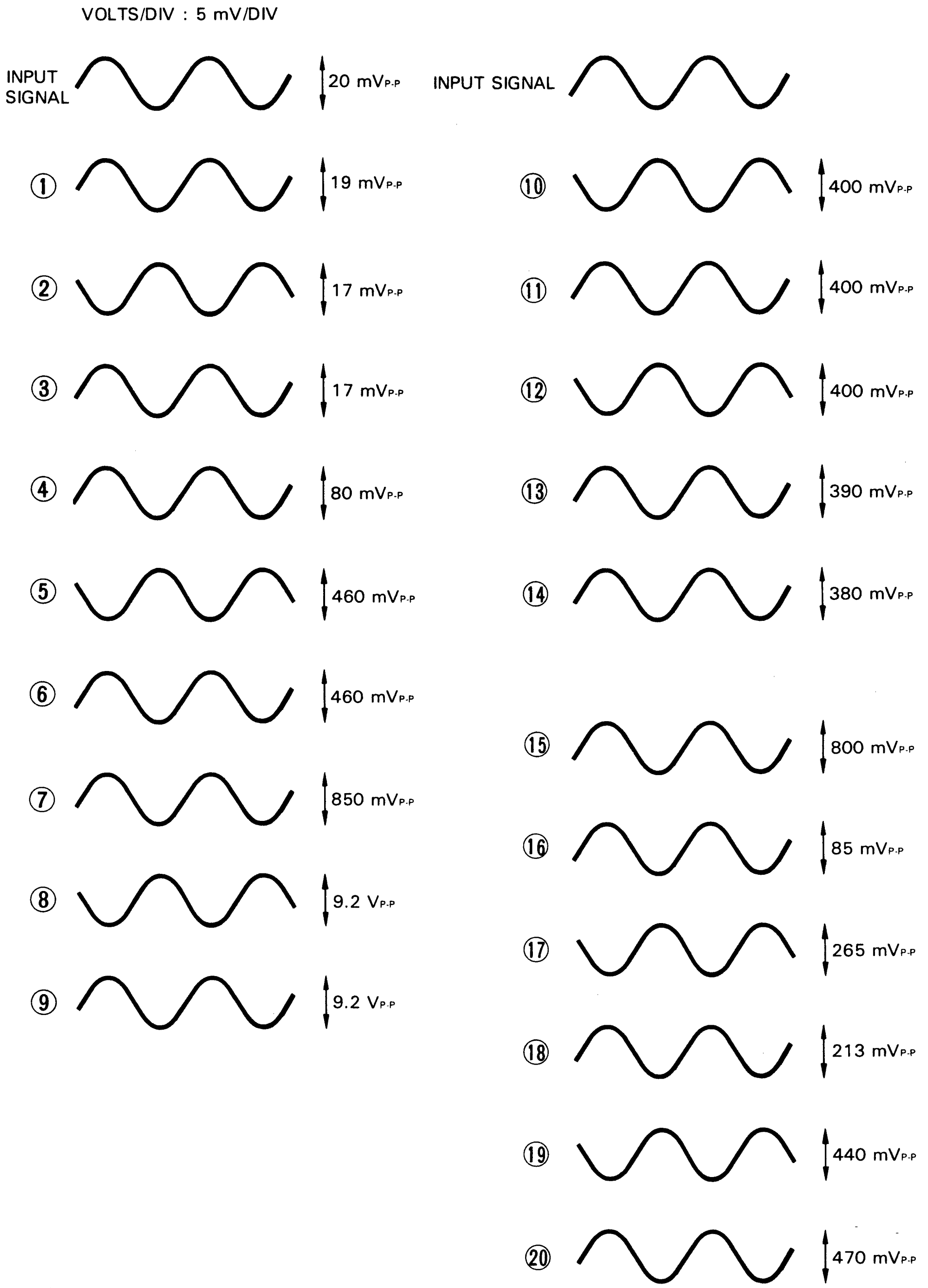
SCHEMATIC DIAGRAM


MODE
CH1 POSITION
CH2 POSITION
CH1 OUT
EXT TRIG
PROBE ADJ
SWEEP GATE OUT
INTENSITY
TRACE ROTATION
SCALE ILLUM
FOCUS
ASTIG
VERTICAL SWITCH UNIT X77-1360-00 C/3
VR1 1KB
VR2 1KB
VR5 500B
VR6 10KB
VR7 5KB
VR8 3MB
VR9 250KB
150FTM31
L1 1.5μ
R1 150 1/4W
L2 1.5μ
R2 150 1/4W
HORIZONTAL OUTPUT UNIT X74-1410-00
SWEEP UNIT X74-1400-00
VERTICAL SWITCH UNIT X77-1360-00 A/3
VERTICAL SWITCH UNIT X77-1360-00 B/3
ATTENUATOR UNIT
VERTICAL HEAD UNIT X73-1580-00
VERTICAL AMP UNIT X73-1590-00
CH1 INPUT
CH2 INPUT
CH1 MEMORY POSITION
CH2 MEMORY POSITION
VR3 500B
VR4 500B
SWITCH BOARD UNIT X69-1030-01 B/2
SWITCH BOARD UNIT X69-1030-01 A/2
TIMEBASE UNIT X71-1120-00
PEN SPEED
10ms
20ms
50ms
S1
S2b
S2a
DISPLAY TIME
VR10 2MB
MEMORY OUT A
MEMORY OUT B
FOR PEN A
FOR PEN B
MEMORY UNIT X81-1460-01
MOTHER BOARD X81-1440-00
CONTROL UNIT X77-1330-00
REFLESH UNIT X81-1450-00
GP-IB INTERFACE UNIT X81-1500-00
CONNECTOR BOARD UNIT X81-1510-00
GP-IB
SG
FG
POWER SUPPLY UNIT X68-1420-00
Z AXIS
POWER LED
ILLUM Tr
Q1 2SD401A
VOLTAGE SELECTOR UNIT X77-1020-03
FAN
T
AC140
AC23
FUSE 1A
TH1
SWITCHING POWER SUPPLY W02-0420-05
POWER
S3b
S3a
AC
EXT CLOCK IN
READ GATE OUT FOR PEN
READ GATE OUT

P. C. BOARD

VERTICAL AMP UNIT (X73-1590-00)

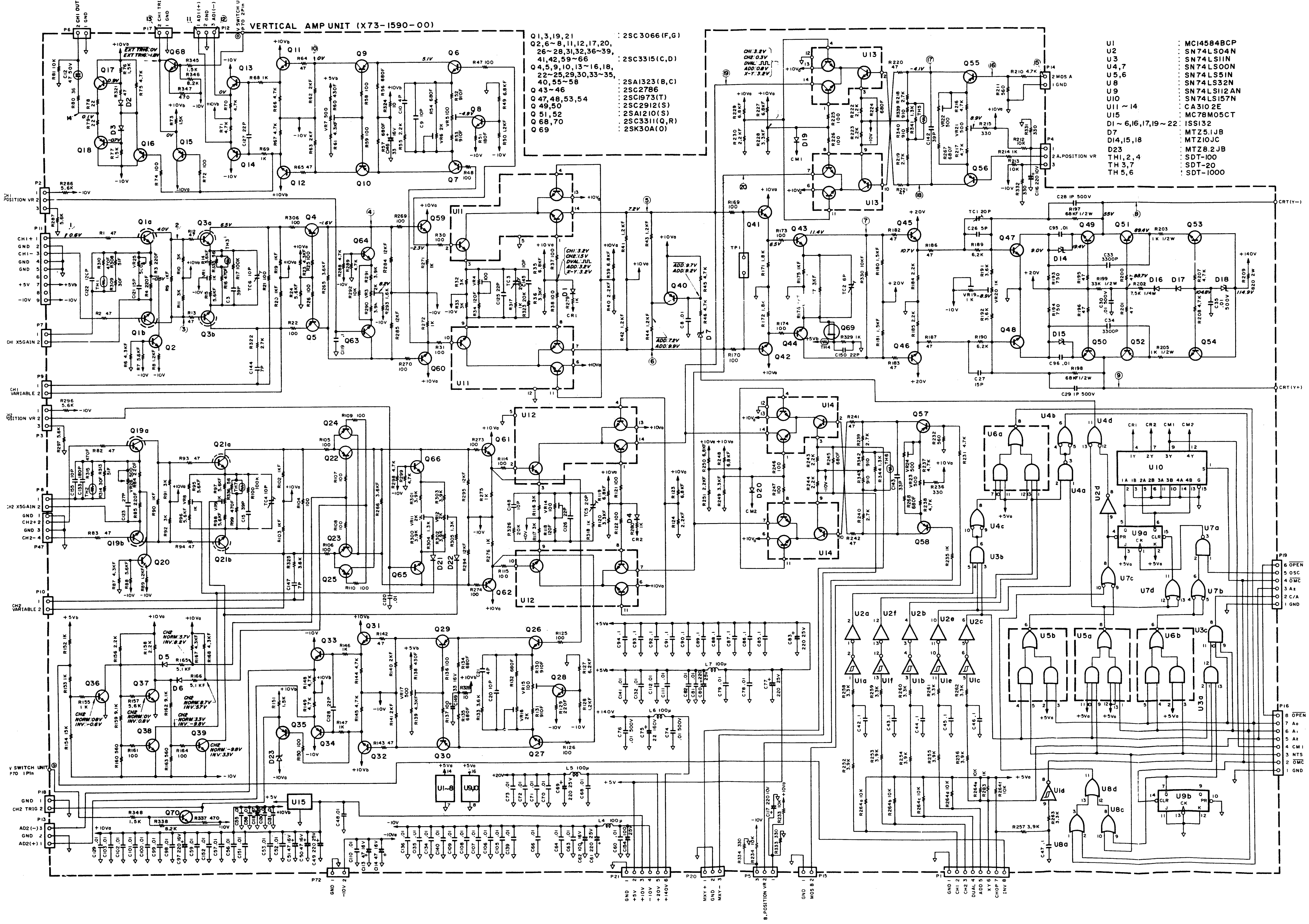

X73-1590-00
+5V
P1
P16
P19
P21
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
TC1
TC2
TC3
TC4
TC5
TC6


VOLTS/DIV : 5 mV/DIV
INPUT SIGNAL
20 mVP-P
INPUT SIGNAL
① 19 mVP-P
② 17 mVP-P
③ 17 mVP-P
④ 80 mVP-P
⑤ 460 mVP-P
⑥ 460 mVP-P
⑦ 850 mVP-P
⑧ 9.2 VP-P
⑨ 9.2 VP-P
⑩ 400 mVP-P
⑪ 400 mVP-P
⑫ 400 mVP-P
⑬ 390 mVP-P
⑭ 380 mVP-P
⑮ 800 mVP-P
⑯ 85 mVP-P
⑰ 265 mVP-P
⑱ 213 mVP-P
⑲ 440 mVP-P
⑳ 470 mVP-P

VR1	CH1	VARIABLE balance adjustment
VR3	CH1	POSITION adjustment
VR4	CH1	GAIN adjustment
VR5	CH1	AD output balance adjustment
VR6	CH1	AD output gain adjustment
VR7	CH1	Trigger DC level adjustment
VR8	CH2	INV VARIABLE balance adjustment
VR9	CH2	NORM VARIABLE balance adjustment
VR11	CH2	INV POSITION adjustment
VR12	CH2	NORM POSITION adjustment
VR14	CH2	Gain adjustment
VR15	CH2	AD output balance adjustment
VR16	CH2	AD output gain adjustment
VR17	CH2	Trigger DC level adjustment
VR19		Vertical output operation point adjustment
VR20		CRT center adjustment
VR21	CH A	MEMORY POSITION adjustment
VR22	CH A	memory gain adjustment
VR23	CH B	MEMORY POSITION adjustment
VR24	CH B	memory gain adjustment
VR25	CH1	High-range square waveform compensation
VR26	CH2	High-range square waveform compensation
TC1		Mid range square waveform compensation
TC2		High range overshoot adjustment
TC3	CH1	Mid and high-range square waveform compensation
TC4	CH2	High-range overshoot adjustment
TC5	CH2	Mid and high-range square waveform compensation
TC6	CH1	High-range overshoot adjustment

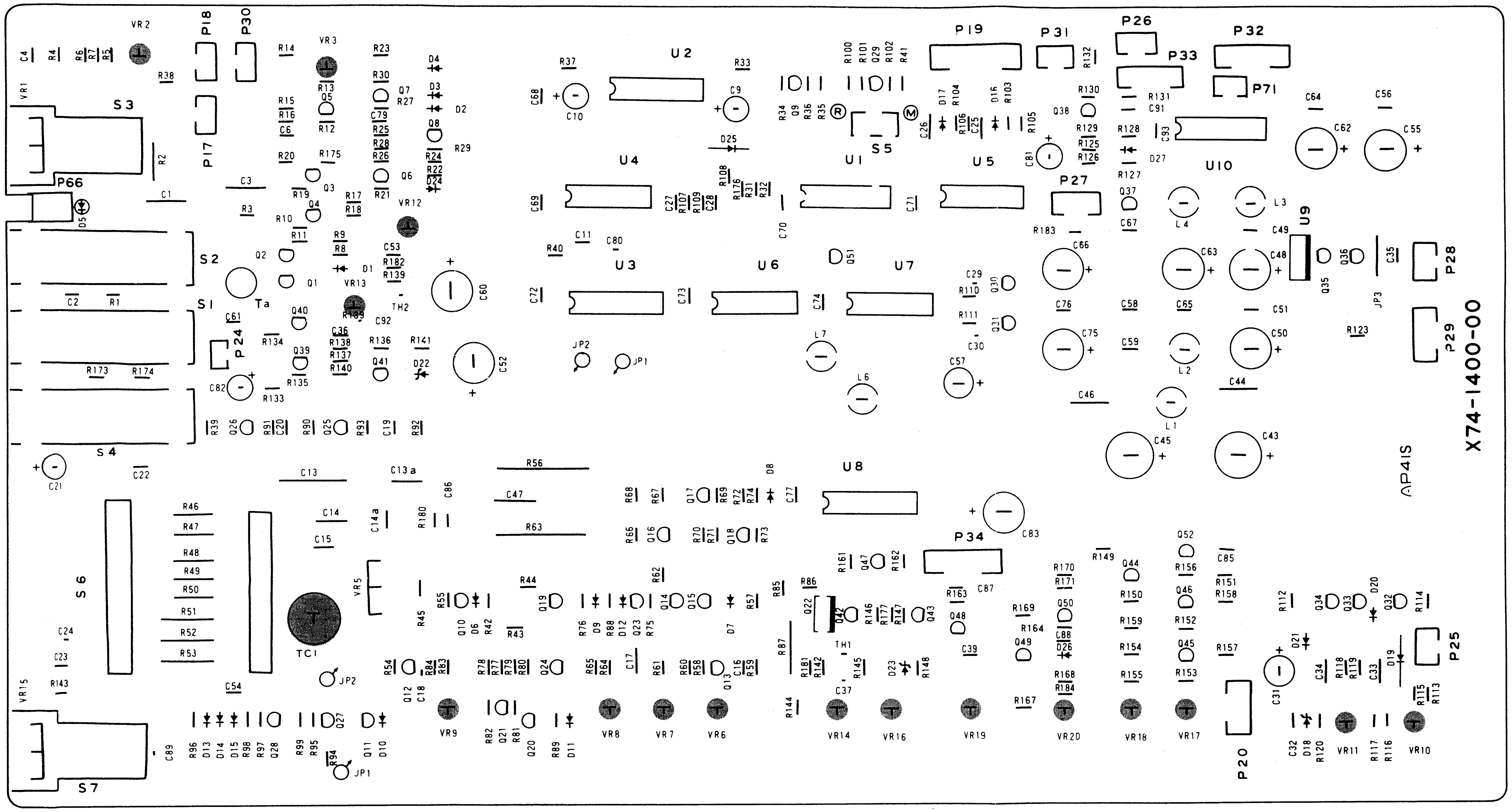
SCHEMATIC DIAGRAM

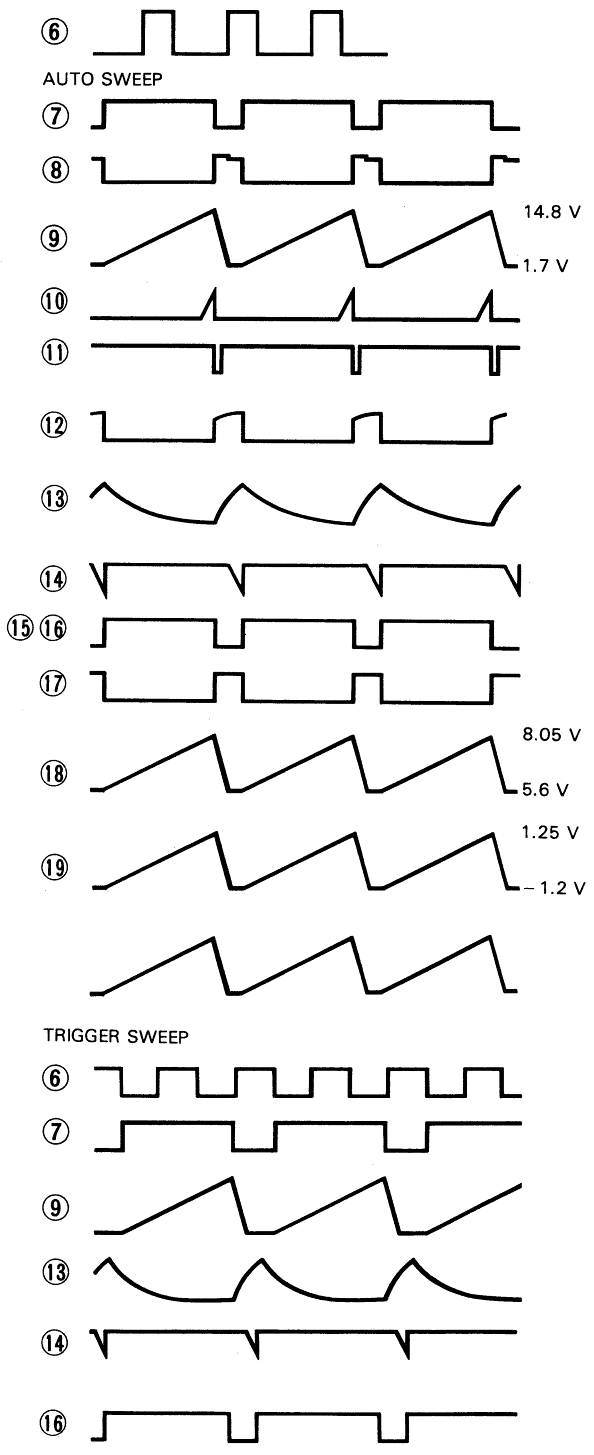
VERTICAL AMP UNIT (X-73-1590-00)

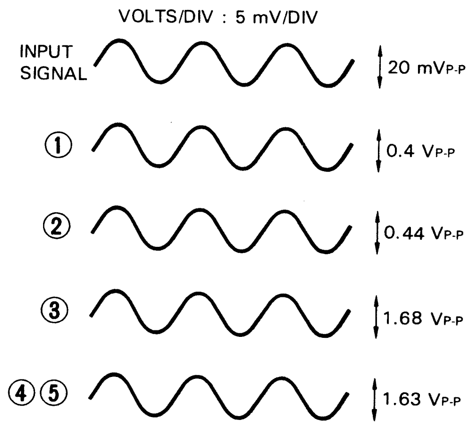

VERTICAL AMP UNIT (X73-1590-00)
Q1,3,19,21 : 2SC3066(F,G)
Q2,6~8,11,12,17,20, 26~28,31,32,36~39, 41,42,59~66 : 2SC3315(C,D)
Q4,5,9,10,13~16,18, 22~25,29,30,33~35, 40,55~58 : 2SA1323(B,C)
Q43~46 : 2SC2786
Q47,48,53,54 : 2SC1973(T)
Q49,50 : 2SC2912(S)
Q51,52 : 2SA1210(S)
Q68,70 : 2SC3311(Q,R)
Q69 : 2SK30A(O)
U1 : MC14584BCP
U2 : SN74LS04N
U3 : SN74LS11N
U4,7 : SN74LS00N
U5,6 : SN74LS51N
U8 : SN74LS32N
U9 : SN74LS112AN
U10 : SN74LS157N
U11~14 : CA3102E
U15 : MC78M05CT
D1~6,16,17,19~22 : 1SS132
D7 : MTZ5.1JB
D14,15,18 : MTZ10JC
D23 : MTZ8.2JB
TH1,2,4 : SDT-100
TH3,7 : SDT-20
TH5,6 : SDT-1000
P6 CH1 OUT
P17 CH1 TRIG
P12 AD1(+) AD1(−)
V SWITCH UNIT P70 2Pin
P2 CH1 POSITION VR
P11 CH1+ GND CH1− GND GND GND +5V −10V
P7 CH1 X5GAIN
P9 CH1 VARIABLE
P3 CH2 POSITION VR
P8 CH2 X5GAIN GND CH2+ GND CH2−
P47
P10 CH2 VARIABLE
V SWITCH UNIT P70 1Pin
P18 GND CH2 TRIG
P13 AD2(−) GND AD2(+)
P72 GND −10V
P21 GND +5V +10V −10V +20V +140V
P20 MXY+ GND MXY−
P5 B.POSITION VR
P15 GND MOS B
P1 GND CH1 CH2 DUAL ADD X-Y CHOP INV B
P14 2 MOS A 1 GND
P4 A.POSITION VR
CRT(Y−)
CRT(Y+)
P19 OPEN OSC OMC Az C/A GND
P16 OPEN A0 A1 Az CM1 NTS OMC GND

P. C. BOARD

SWEEP UNIT (X74-1400-00)


X74-1400-00
AP41S
S1
S2
S3
S4
S5
S6
S7
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
P17
P18
P19
P20
P24
P25
P26
P27
P28
P29
P30
P31
P32
P33
P34
P66
P71
VR1
VR2
VR3
VR5
VR6
VR7
VR8
VR9
VR10
VR11
VR12
VR13
VR14
VR15
VR16
VR17
VR18
VR19
VR20
TC1
JP1
JP2
JP3
TH1
TH2

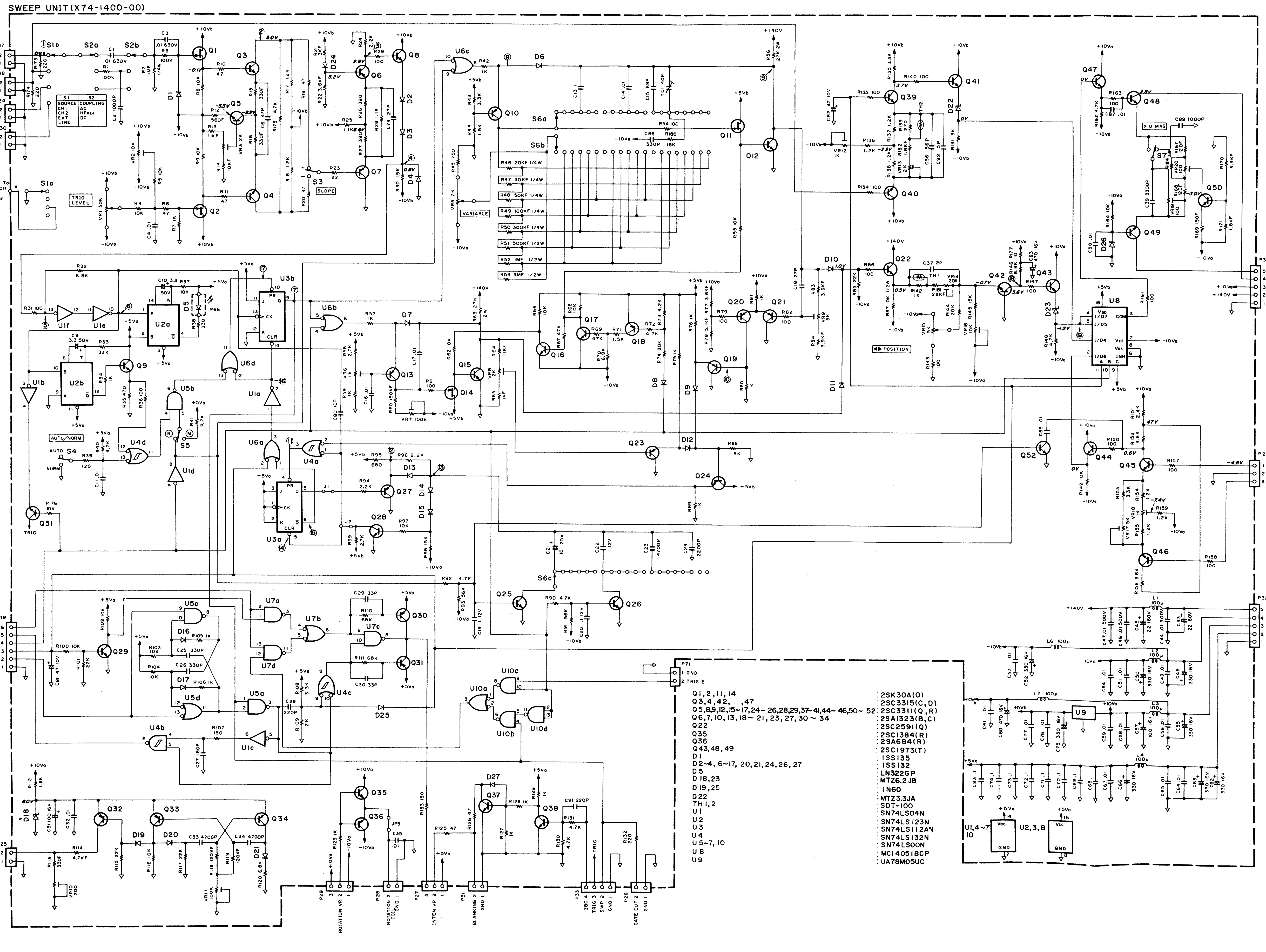

⑥
AUTO SWEEP
⑦
⑧
⑨
14.8 V
1.7 V
⑩
⑪
⑫
⑬
⑭
⑮⑯
⑰
⑱
8.05 V
5.6 V
⑲
1.25 V
− 1.2 V
TRIGGER SWEEP
⑥
⑦
⑨
⑬
⑭
⑯


VOLTS/DIV : 5 mV/DIV
INPUT SIGNAL
20 mVP-P
①
0.4 VP-P
②
0.44 VP-P
③
1.68 VP-P
④⑤
1.63 VP-P

VR2	TRIG. LEVEL center adjustment
VR3	TRIG. SLOPE center adjustment
VR6	For memory, sweep start point adjustment
VR7	For memory, sweep time adjustment
VR8	For memory, sweep length adjustment
VR9	For oscilloscope, sweep length adjustment
VR10	Calibration voltage output adjustment
VR11	Calibration voltage frequency adjustment
VR,12	X-Y POSITION adjustment
VR13	X-Y gain adjustment
VR14	Sweep time adjustment
VR16	Sweep POSITION adjustment
VR17	Memory X-Y gain adjustment
VR18	Memory X-Y POSITION adjustment
VR19	X10MAG. gain adjustment
VR20	X10MAG. balance adjustment
TC1	Fast sweep time adjustment

SCHEMATIC DIAGRAM

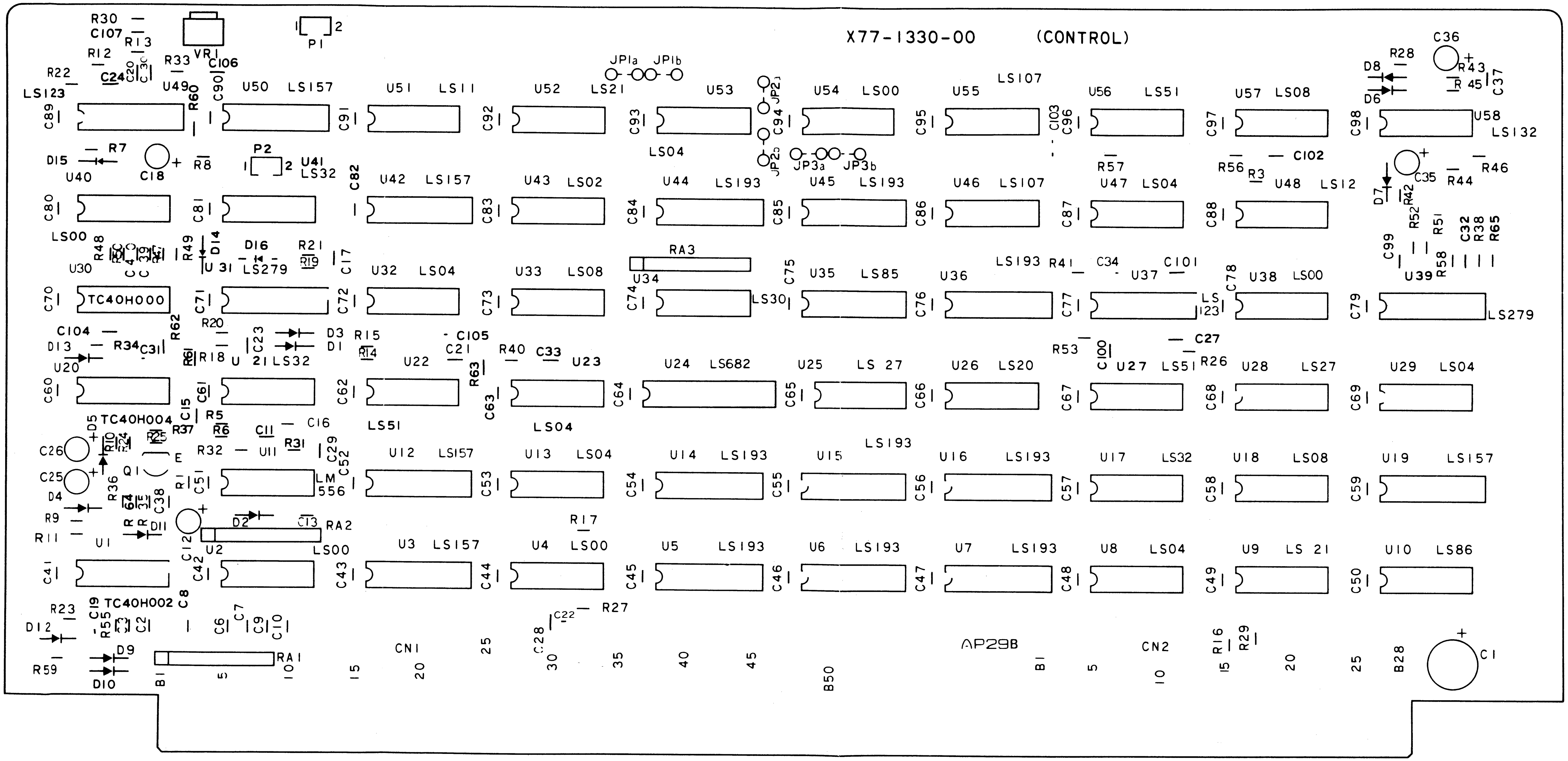
SWEEP UNIT (X74-1400-00)


SWEEP UNIT (X74-1400-00)
P17 CH1 TRIG 2 GND 1
P18 CH2 TRIG 2 GND 1
P24 EXT 2 GND 1
P30 LINE 2 GND 1
V SWITCH UNIT P70-3pin
S1 SOURCE CH1 CH2 EXT LINE
S2 COUPLING AC HFREJ DC
TRIG LEVEL
S3 SLOPE
VARIABLE
AUTO/NORM
S4 AUTO NORM
S5
TRIG
X10 MAG
POSITION
P34 5 +SWEEP 4 -SWEEP 3 +10V 2 +140V 1 GND
P20 1 MXY- 2 GND 3 MXY+
P32 5 +140V 4 -10V 3 +10V 2 +5V 1 GND
P19 OPEN 6 OSC 5 OMC 4 A2 3 C/A 2 GND 1
P25 CAL 2 GND 1
P71 1 GND 2 TRIG E
P29 ROTATION VR
P28 ROTATION COIL GND
P27 INTEN VR
P31 BLANKING GND
P33 ZBC TRIG SWP GND
P26 GATE OUT GND
U1,4~7,10
U2,3,8
Vcc
GND
+5Va

Q1,2,11,14	2SK30A(O)
Q3,4,42, ,47	2SC3315(C,D)
Q5,8,9,12,15~17,24~26,28,29,37~41,44~46,50~52	2SC3311(Q,R)
Q6,7,10,13,18~21,23,27,30~34	2SA1323(B,C)
Q22	2SC2591(Q)
Q35	2SC1384(R)
Q36	2SA684(R)
Q43,48,49	2SC1973(T)
D1	1SS135
D2~4,6~17,20,21,24,26,27	1SS132
D5	LN322GP
D18,23	MTZ6.2JB
D19,25	1N60
D22	MTZ3.3JA
TH1,2	SDT-100
U1	SN74LS04N
U2	SN74LS123N
U3	SN74LS112AN
U4	SN74LS132N
U5~7,10	SN74LS00N
U8	MC14051BCP
U9	UA78M05UC

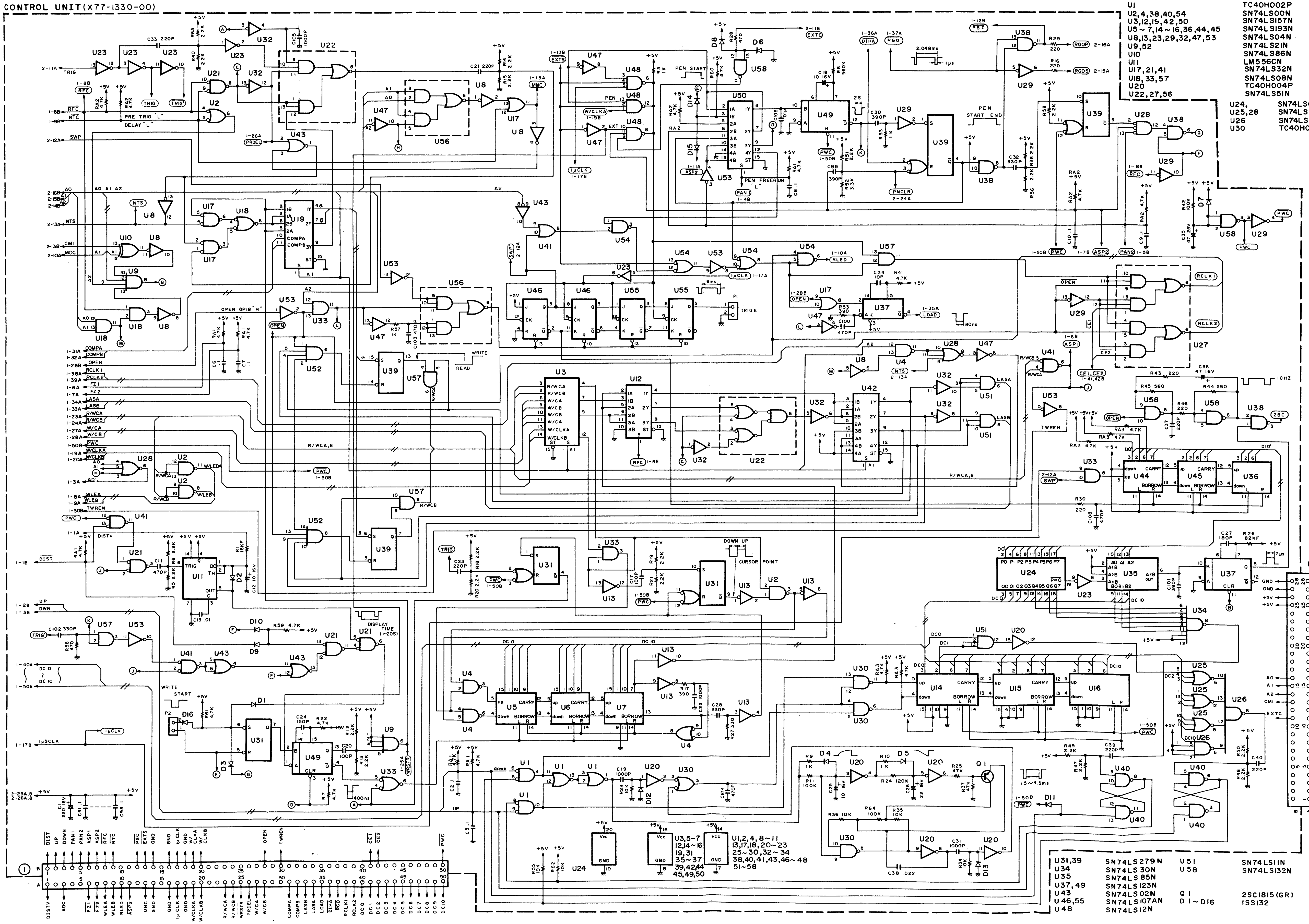
P. C. BOARD

CONTROL UNIT (X77-1330-00)


X77-1330-00 (CONTROL)
VR1
P1
P2
JP1a JP1b
JP2a JP2b
JP3a JP3b
U49 LS123
U50 LS157
U51 LS11
U52 LS21
U53 LS04
U54 LS00
U55 LS107
U56 LS51
U57 LS08
U58 LS132
U40 LS00
U41 LS32
U42 LS157
U43 LS02
U44 LS193
U45 LS193
U46 LS107
U47 LS04
U48 LS12
U30 TC40H000
U31 LS279
U32 LS04
U33 LS08
U34 LS30
U35 LS85
U36 LS193
U37 LS123
U38 LS00
U39 LS279
U20 TC40H004
U21 LS32
U22 LS51
U23 LS04
U24 LS682
U25 LS 27
U26 LS20
U27 LS51
U28 LS27
U29 LS04
U11 LM556
U12 LS157
U13 LS04
U14 LS193
U15 LS193
U16 LS193
U17 LS32
U18 LS08
U19 LS157
U1 TC40H002
U2 LS00
U3 LS157
U4 LS00
U5 LS193
U6 LS193
U7 LS193
U8 LS04
U9 LS 21
U10 LS86
RA1
RA2
RA3
Q1
CN1
CN2
AP29B
B1 5 10 15 20 25 30 35 40 45 B50
B1 5 10 15 20 25 B28
C1
C36
D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12 D13 D14 D15 D16

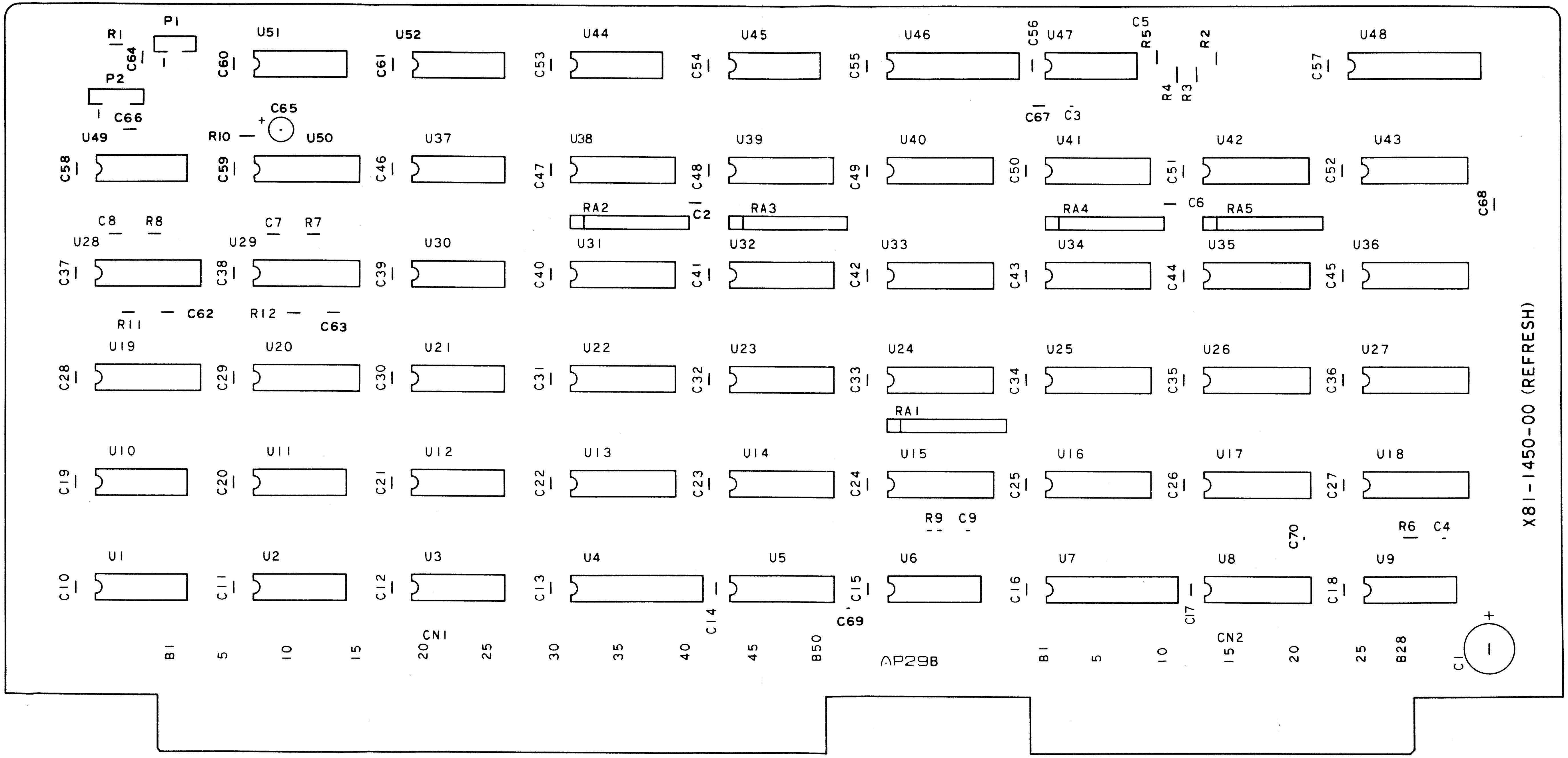
SCHEMATIC DIAGRAM

CONTROL UNIT (X77-1330-00)


CONTROL UNIT(X77-1330-00)
U1 TC40H002P
U2,4,38,40,54 SN74LS00N
U3,12,19,42,50 SN74LS157N
U5～7,14～16,36,44,45 SN74LS193N
U8,13,23,29,32,47,53 SN74LS04N
U9,52 SN74LS21N
U10 SN74LS86N
U11 LM556CN
U17,21,41 SN74LS32N
U18,33,57 SN74LS08N
U20 TC40H004P
U22,27,56 SN74LS51N
U24, SN74LS682N
U25,28 SN74LS27N
U26 SN74LS20N
U30 TC40H000P
U31,39 SN74LS279N
U34 SN74LS30N
U35 SN74LS85N
U37,49 SN74LS123N
U43 SN74LS02N
U46,55 SN74LS107AN
U48 SN74LS12N
U51 SN74LS11N
U58 SN74LS132N
Q1 2SC1815(GR)
D1～D16 1SS132
+5V 16 Vcc GND 8 U3,5～7 12,14～16 19,31 35～37 39,42,44 45,49,50
+5V 14 Vcc GND 7 U1,2,4,8～11 13,17,18,20～23 25～30,32～34 38,40,41,43,46～48 51～58
PEN START
PEN FREERUN "L"
PEN START END
PRE TRIG "L"
DELAY "L"
OPEN GPIB "H"
DISPLAY TIME (1-20S)
WRITE START
CURSOR POINT
TRIG E
TWREN

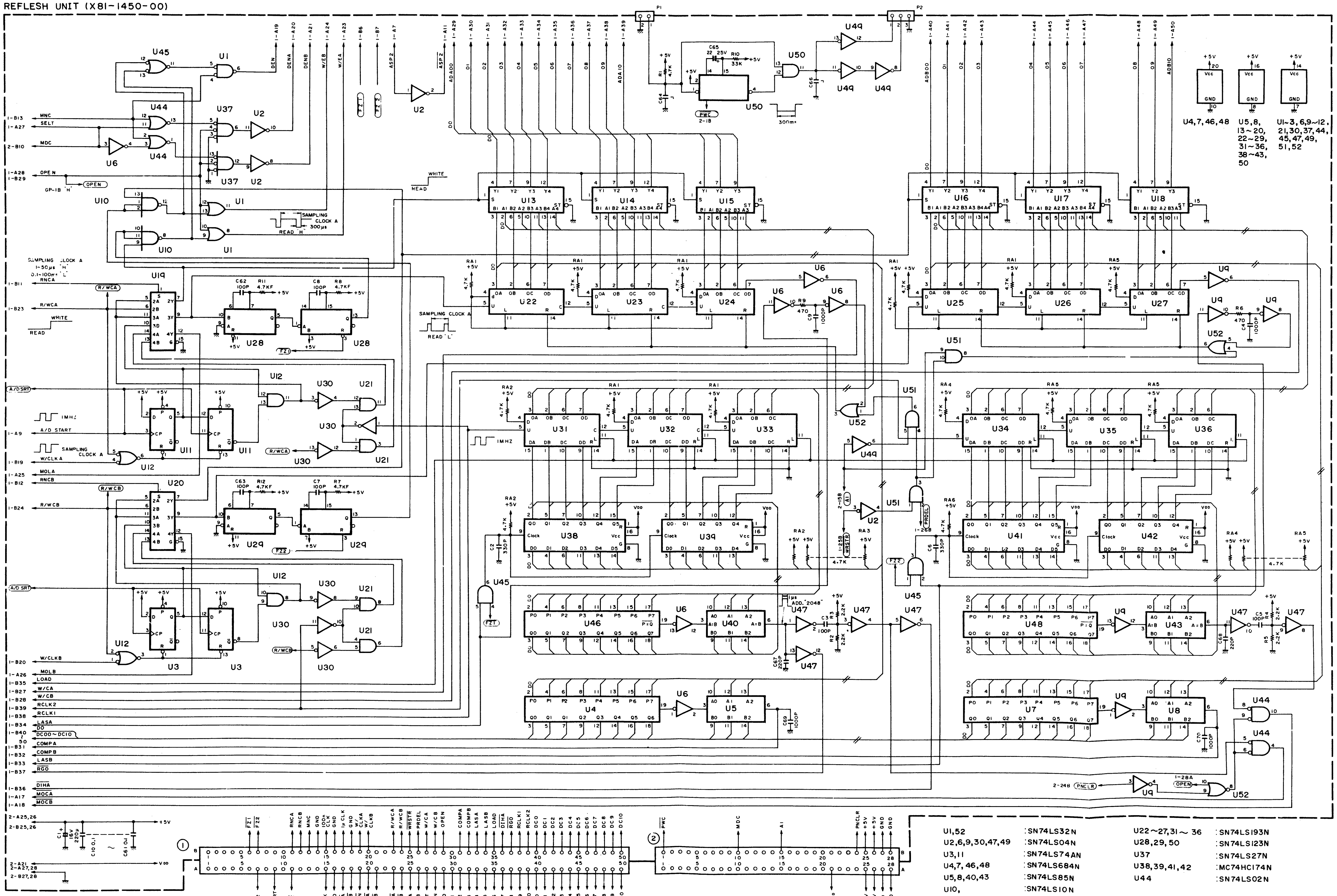
P. C. BOARD

REFLESH UNIT (X81-1450-00)


P1
R1
C64
P2
C66
U51
C60
U52
C61
U44
C53
U45
C54
U46
C55
C56
U47
C5
R5
R2
R4
R3
U48
C57
C65
R10
C67
C3
U49
C58
U50
C59
U37
C46
U38
C47
U39
C48
U40
C49
U41
C50
U42
C51
U43
C52
C68
RA2
C2
RA3
RA4
C6
RA5
C8
R8
C7
R7
U28
U29
U30
U31
U32
U33
U34
U35
U36
C37
C38
C39
C40
C41
C42
C43
C44
C45
R11
C62
R12
C63
U19
U20
U21
U22
U23
U24
U25
U26
U27
C28
C29
C30
C31
C32
C33
C34
C35
C36
RA1
U10
U11
U12
U13
U14
U15
U16
U17
U18
C19
C20
C21
C22
C23
C24
C25
C26
C27
R9
C9
C70
R6
C4
U1
U2
U3
U4
U5
U6
U7
U8
U9
C10
C11
C12
C13
C14
C15
C69
C16
C17
C18
CN1
B1
5
10
15
20
25
30
35
40
45
B50
AP29B
CN2
B1
5
10
15
20
25
B28
C1
X81-1450-00 (REFRESH)

SCHEMATIC DIAGRAM

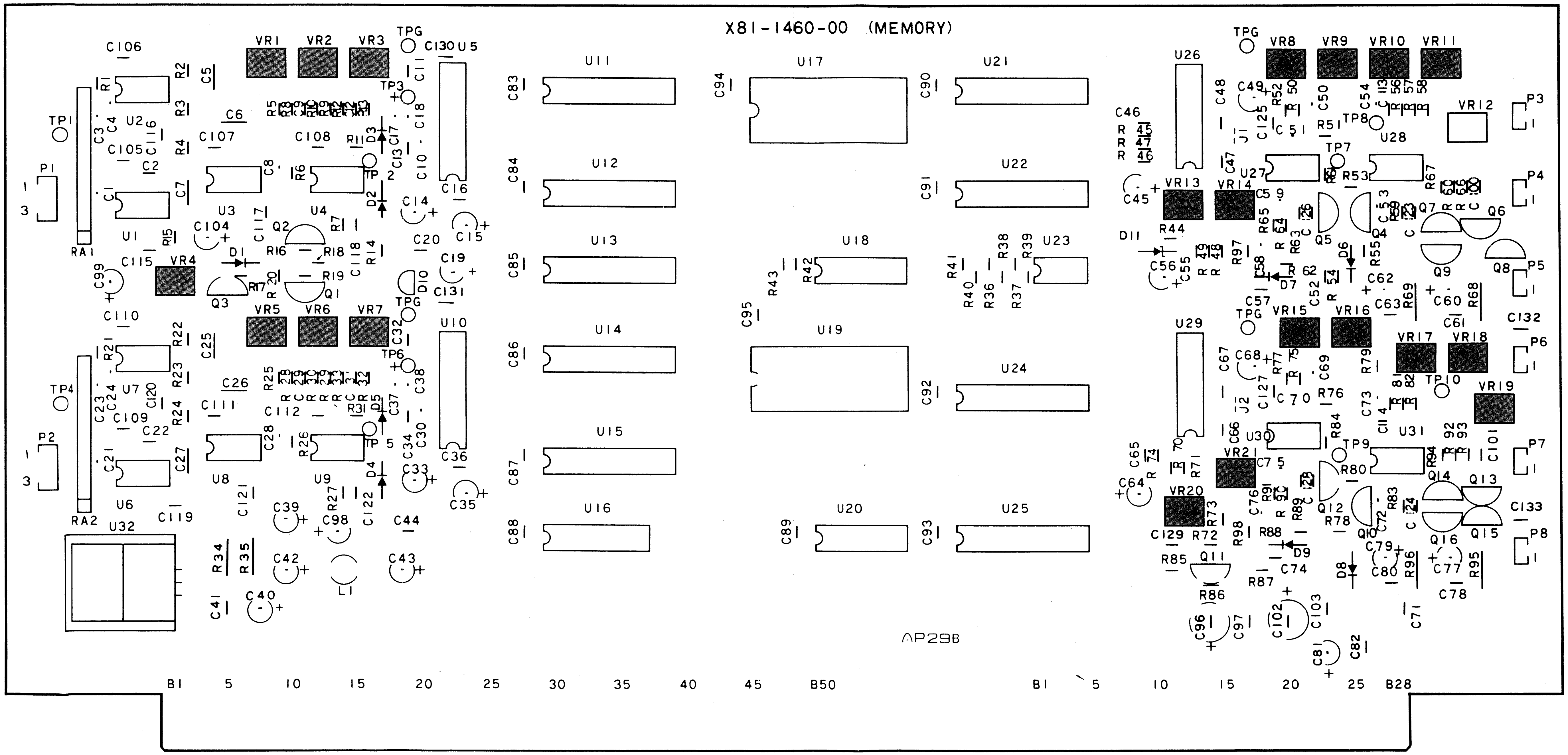
REFLESH UNIT (X81-1450-00)


REFLESH UNIT (X81-1450-00)
P1
P2
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
U18
U19
U20
U21
U22
U23
U24
U25
U26
U27
U28
U29
U30
U31
U32
U33
U34
U35
U36
U37
U38
U39
U40
U41
U42
U43
U44
U45
U46
U47
U48
U49
U50
U51
U52
SAMPLING CLOCK A
300μs
READ 'H'
READ 'L'
WHITE
READ
1MHZ
A/D START
A/D SRT
R/WCA
R/WCB
W/CLKA
W/CLKB
MOLA
MOLB
RNCA
RNCB
MNC
SELT
MDC
OPEN
GP-IB 'H'
FZ1
FZ2
PWC
PNCLR
PRDEL
WRSTR
ADD. 2048
300ms
LOAD
W/CA
W/CB
RCLK2
RCLK1
LASA
DC00~DC10
COMPA
COMPB
LASB
RGO
DIHA
MOCA
MOCB
U4,7,46,48
U5,8, 13~20, 22~29, 31~36, 38~43, 50
U1~3, 6,9~12, 21,30,37,44, 45,47,49, 51,52
+5V
Vcc
GND
VDD
①
②

U1,52	:SN74LS32N	U22~27,31~36	:SN74LS193N
U2,6,9,30,47,49	:SN74LS04N	U28,29,50	:SN74LS123N
U3,11	:SN74LS74AN	U37	:SN74LS27N
U4,7,46,48	:SN74LS684N	U38,39,41,42	:MC74HC174N
U5,8,40,43	:SN74LS85N	U44	:SN74LS02N
U10,	:SN74LS10N		
U12,21,45,51	:SN74LS08N		
U13~20	:SN74LS157N		

P. C. BOARD

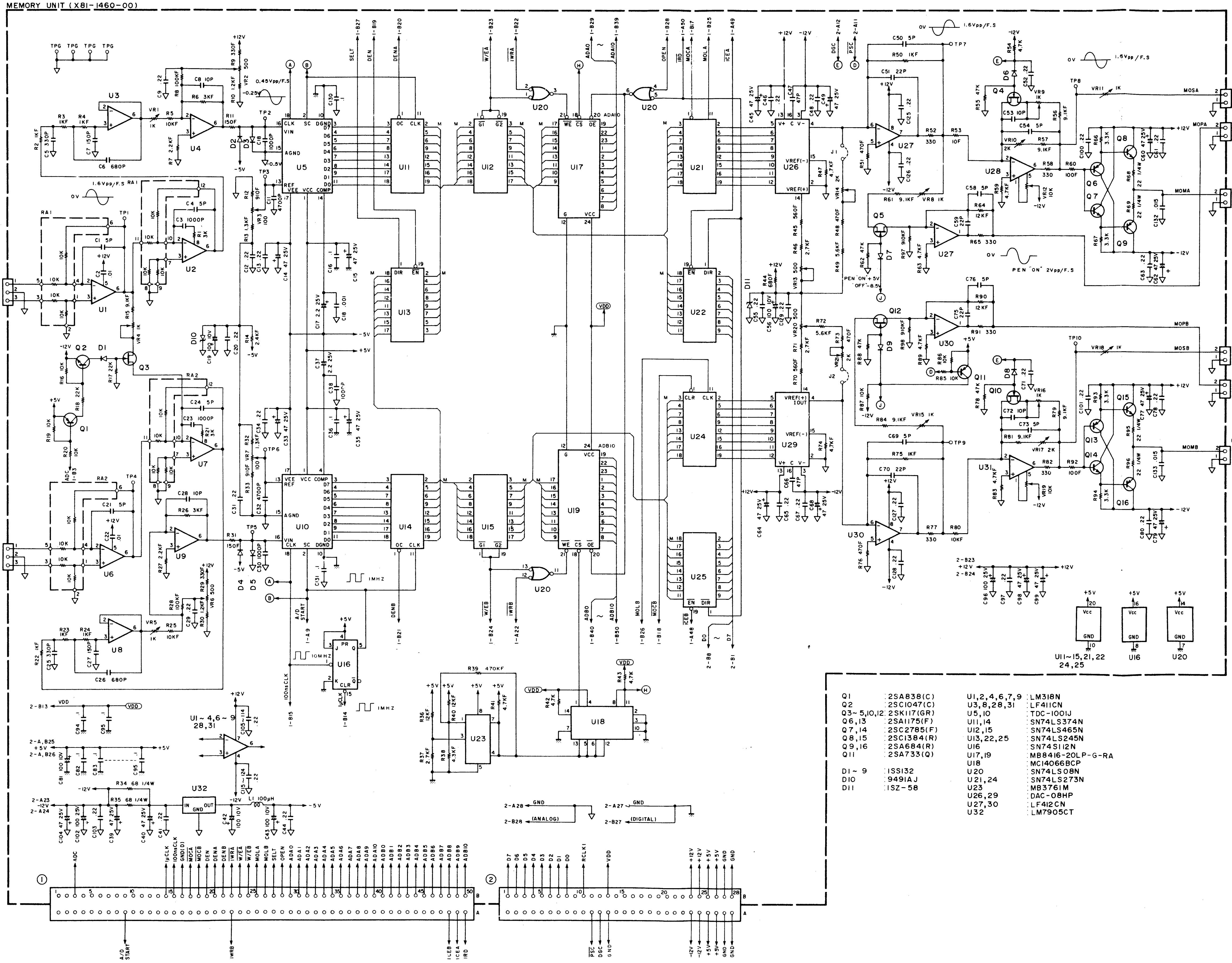
MEMORY UNIT (X81-1460-00)


X81-1460-00 (MEMORY)
VR1
VR2
VR3
VR4
VR5
VR6
VR7
VR8
VR9
VR10
VR11
VR12
VR13
VR14
VR15
VR16
VR17
VR18
VR19
VR20
VR21
TPG
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
P1
P2
P3
P4
P5
P6
P7
P8
RA1
RA2
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
U18
U19
U20
U21
U22
U23
U24
U25
U26
U27
U28
U29
U30
U31
U32
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
L1
J1
J2
AP29B
B1
5
10
15
20
25
30
35
40
45
B50
B1
5
10
15
20
25
B28

VR1	CH1 gain adjustment
VR2	CH1 input offset adjustment
VR3	CH1 A/D VREF adjustment
VR4	ADD gain adjustment
VR5	CH2 input gain adjustment
VR6	CH2 input offset adjustment
VR7	CH2 A/D VREF adjustment
VR8	CH1 PEN OUT gain adjustment
VR9	CH1 4 div gain adjustment
VR10	CH1 MEMORY OUT gain adjustment
VR11	CH1 MONITOR OUT gain adjustment
VR12	CH1 4 div/8 div select offset adjustment
VR13	CH1 D/A gain adjustment
VR14	CH1 D/A offset adjustment
VR15	CH2 PEN OUT gain adjustment
VR16	CH2 4 div gain adjustment
VR17	CH2 MEMORY OUT gain adjustment
VR18	CH2 MONITOR OUT gain adjustment
VR19	CH2 4 div/8 div select offset adjustment
VR20	CH2 D/A gain adjustment
VR21	CH2 D/A offset adjustment

SCHEMATIC DIAGRAM

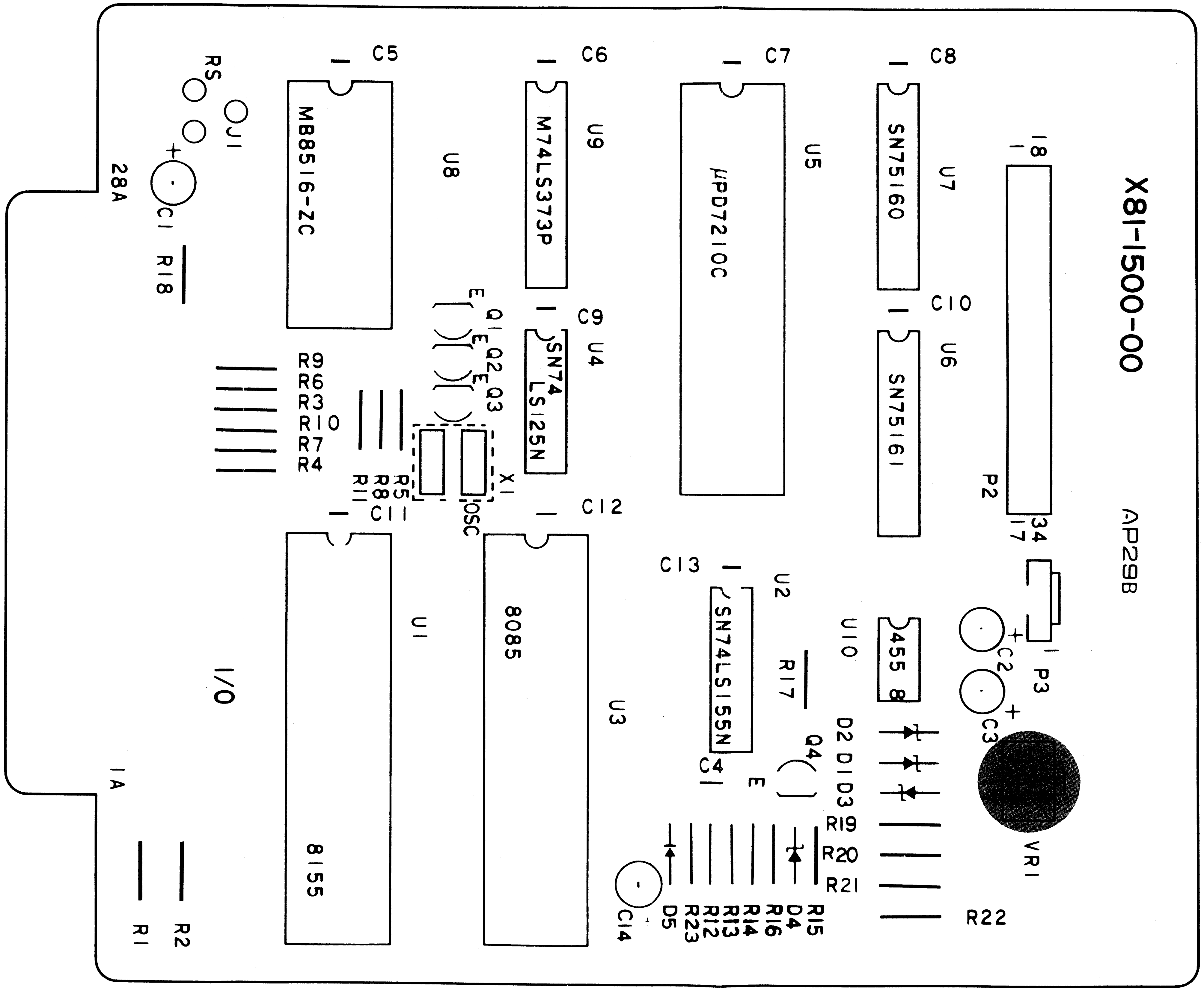
MEMORY UNIT (X81-1460-00)


MEMORY UNIT (X81-1460-00)
CH1
CH2
P1
P2
P3 CH1 MONITOR
P4 CH1 PEN
P5 CH1 MEMORY
P6 CH2 MONITOR
P7 CH2 PEN
P8 CH2 MEMORY
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
U18
U19
U20
U21
U22
U23
U24
U25
U26
U27
U28
U29
U30
U31
U32
1.6Vpp/F.S
0.45Vpp/F.S
PEN "ON" 2Vpp/F.S
PEN "ON" +5V "OFF" -8.5V
1MHZ
10MHZ
MOSA
MOPA
MOMA
MOSB
MOPB
MOMB
2-A28 GND
2-B28 (ANALOG)
2-A27 GND
2-B27 (DIGITAL)
U11~15,21,22 24,25
U16
U20
①
②
A/D START
IWRB
I.EB
ICEA
IRD
PSC
DGC
GND
-12V
+12V
+5V

Q1	:2SA838(C)	U1,2,4,6,7,9	:LM318N
Q2	:2SC1047(C)	U3,8,28,31	:LF411CN
Q3~5,10,12	:2SK117(GR)	U5,10	:TDC-1001J
Q6,13	:2SA1175(F)	U11,14	:SN74LS374N
Q7,14	:2SC2785(F)	U12,15	:SN74LS465N
Q8,15	:2SC1384(R)	U13,22,25	:SN74LS245N
Q9,16	:2SA684(R)	U16	:SN74S112N
Q11	:2SA733(Q)	U17,19	:MB8416-20LP-G-RA
		U18	:MC14066BCP
D1~9	:1SS132	U20	:SN74LS08N
D10	:9491AJ	U21,24	:SN74LS273N
D11	:1SZ-58	U23	:MB3761M
		U26,29	:DAC-08HP
		U27,30	:LF412CN
		U32	:LM7905CT

P. C. BOARD

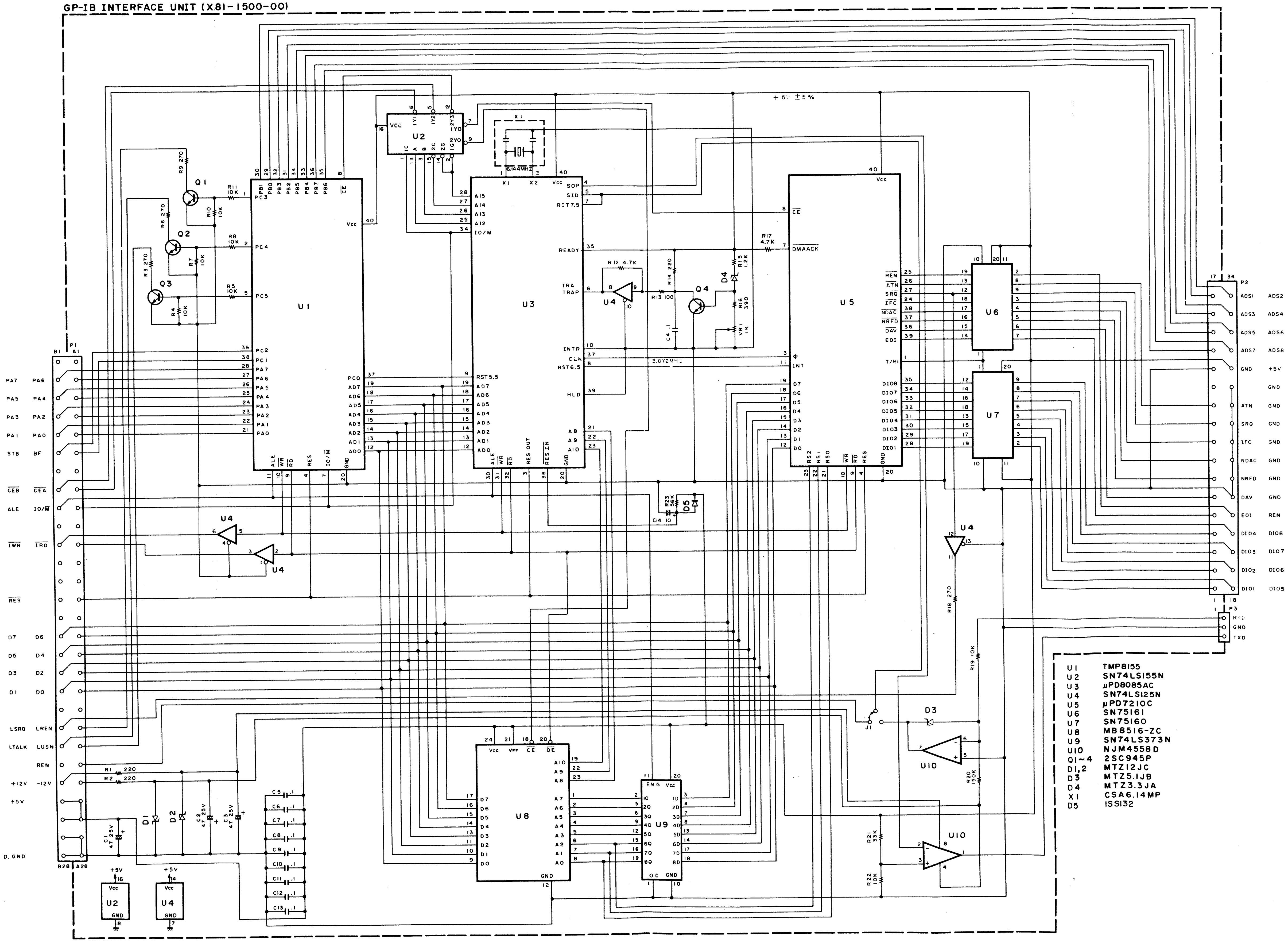
GP-IB UNIT (X81-1500-00)


X81-1500-00
AP29B
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C1
C2
C3
C4
MB8516-ZC
U8
M74LS373P
U9
μPD7210C
U5
SN75160
U7
SN75161
U6
SN74LS125N
U4
8155
U1
8085
U3
SN74LS155N
U2
555
U10
RS
J1
28A
1A
I/O
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
Q1
Q2
Q3
Q4
E
X1
OSC
D1
D2
D3
D4
D5
P2
P3
18
1
34
17
VR1

VR1 Power supply down adjustment

SCHEMATIC DIAGRAM

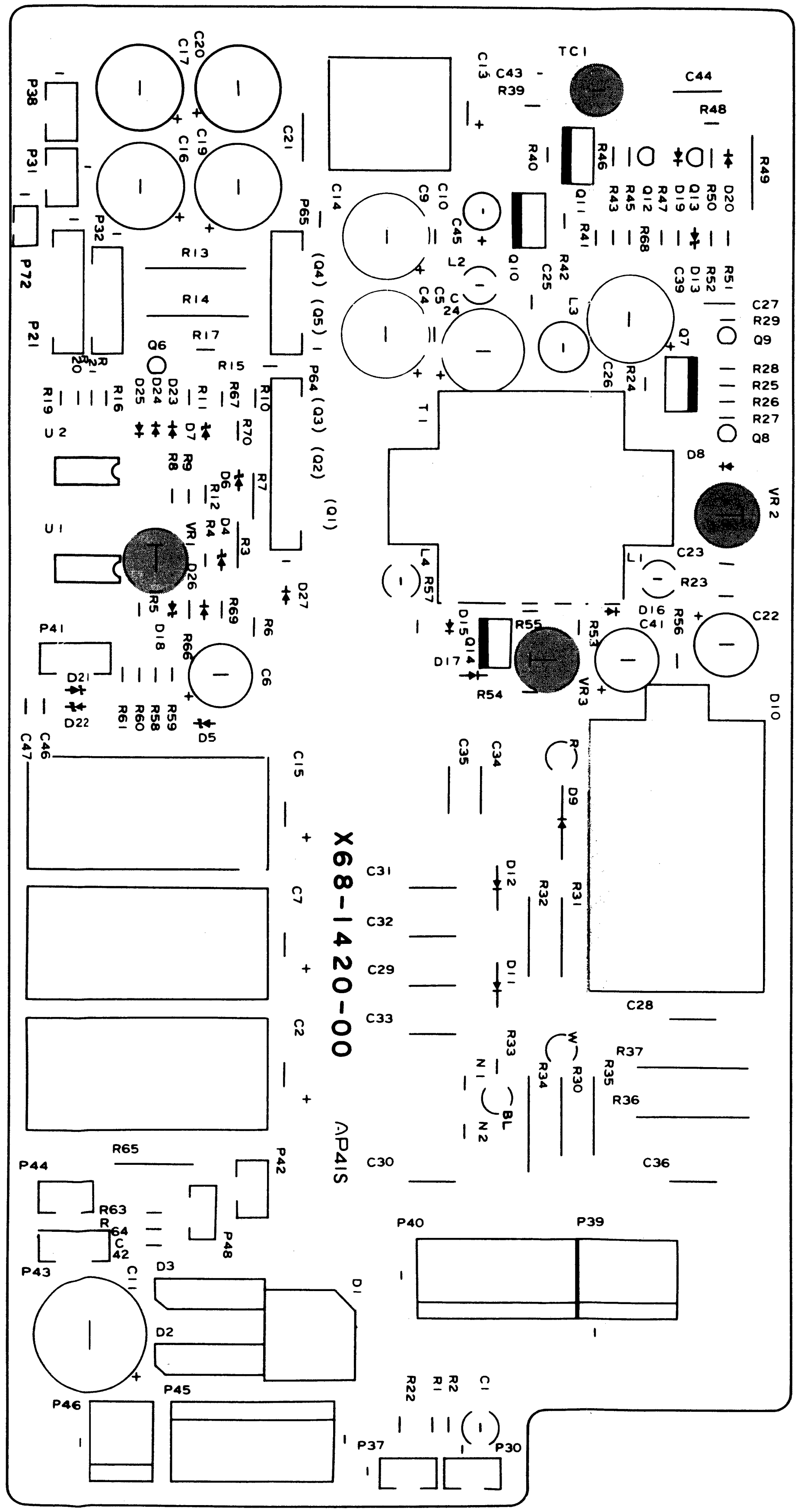
GP-IB UNIT (X81-1500-00)

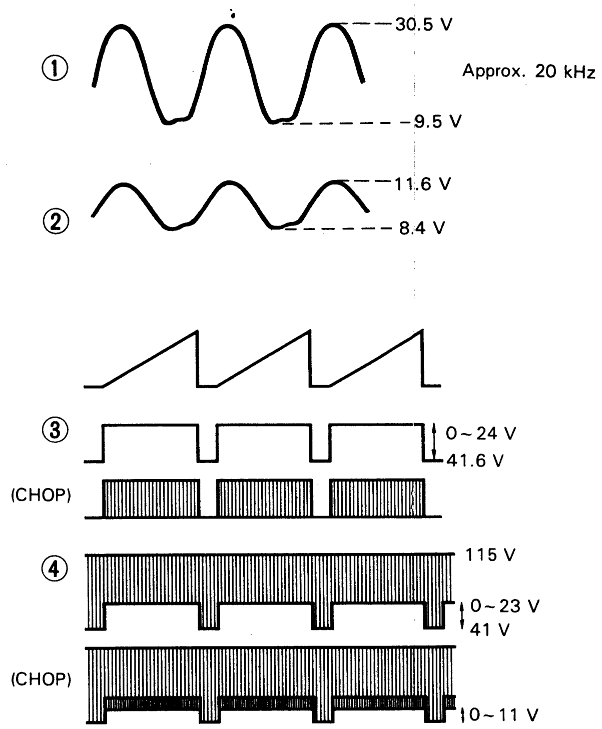

GP-IB INTERFACE UNIT (X81-1500-00)
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
Q1
Q2
Q3
Q4
D1
D2
D3
D4
D5
X1
6.144MHZ
3.072MHZ
+5V ±5%
P1
P2
P3
J1
PA7 PA6
PA5 PA4
PA3 PA2
PA1 PA0
STB BF
CEB CEA
ALE IO/M
IWR IRD
RES
D7 D6
D5 D4
D3 D2
D1 D0
LSRQ LREN
LTALK LUSN
REN
+12V -12V
+5V
D. GND
ADS1 ADS2
ADS3 ADS4
ADS5 ADS6
ADS7 ADS8
GND +5V
ATN GND
SRQ GND
IFC GND
NDAC GND
NRFD GND
DAV GND
EOI REN
DIO4 DIO8
DIO3 DIO7
DIO2 DIO6
DIO1 DIO5
RXD
GND
TXD

U1	TMP8155
U2	SN74LS155N
U3	μPD8085AC
U4	SN74LS125N
U5	μPD7210C
U6	SN75161
U7	SN75160
U8	MB8516-ZC
U9	SN74LS373N
U10	NJM4558D
Q1~4	2SC945P
D1,2	MTZ12JC
D3	MTZ5.1JB
D4	MTZ3.3JA
X1	CSA6.14MP
D5	1SS132

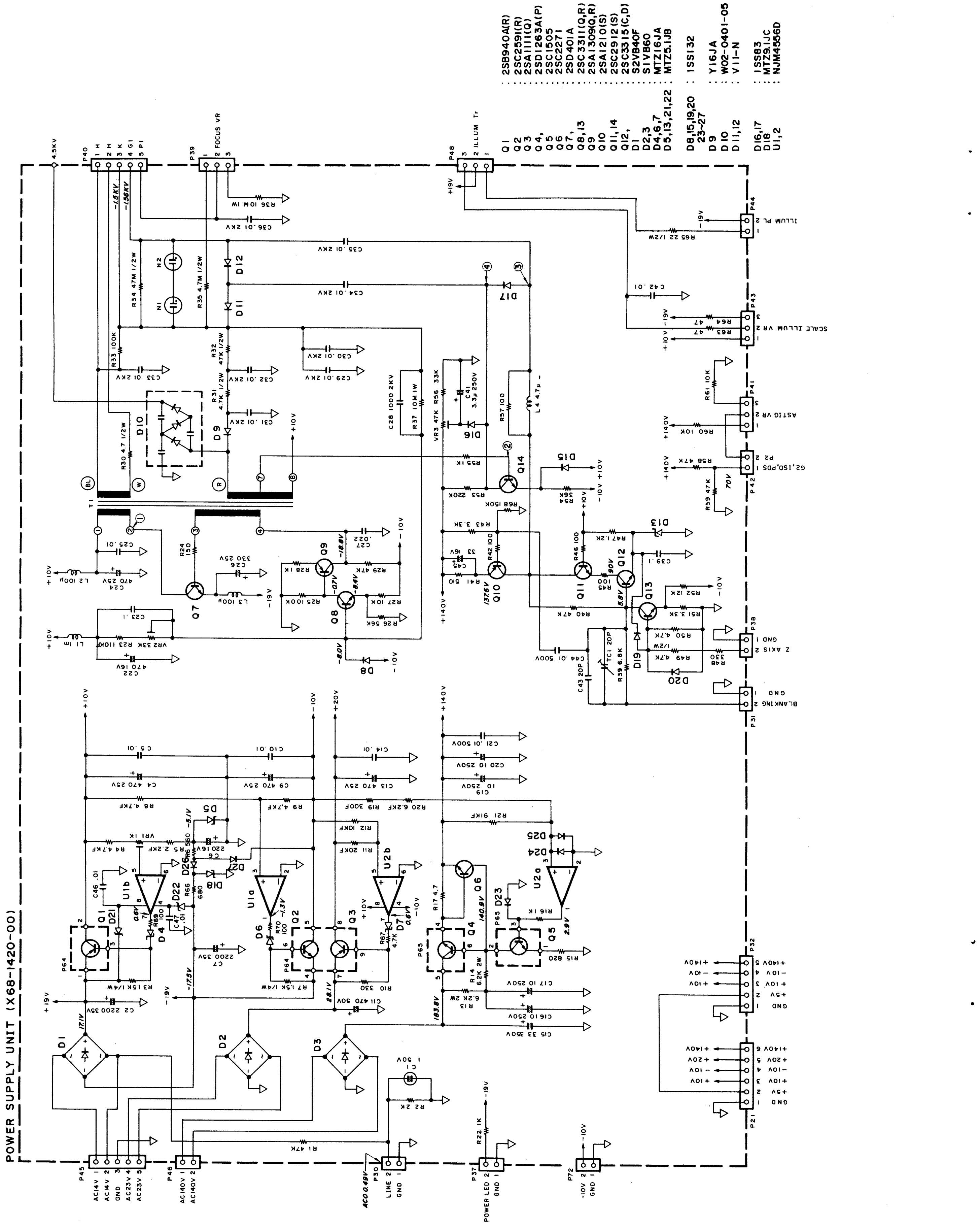
POWER SUPPLY UNIT (X68-1420 00)

P. C. BOARD/SCHEMATIC DIAGRAM


X68-1420-00
AP41S
TC1
VR1
VR2
VR3
P38
P31
P32
P72
P21
P65
P41
P44
P42
P43
P48
P46
P45
P40
P39
P37
P30

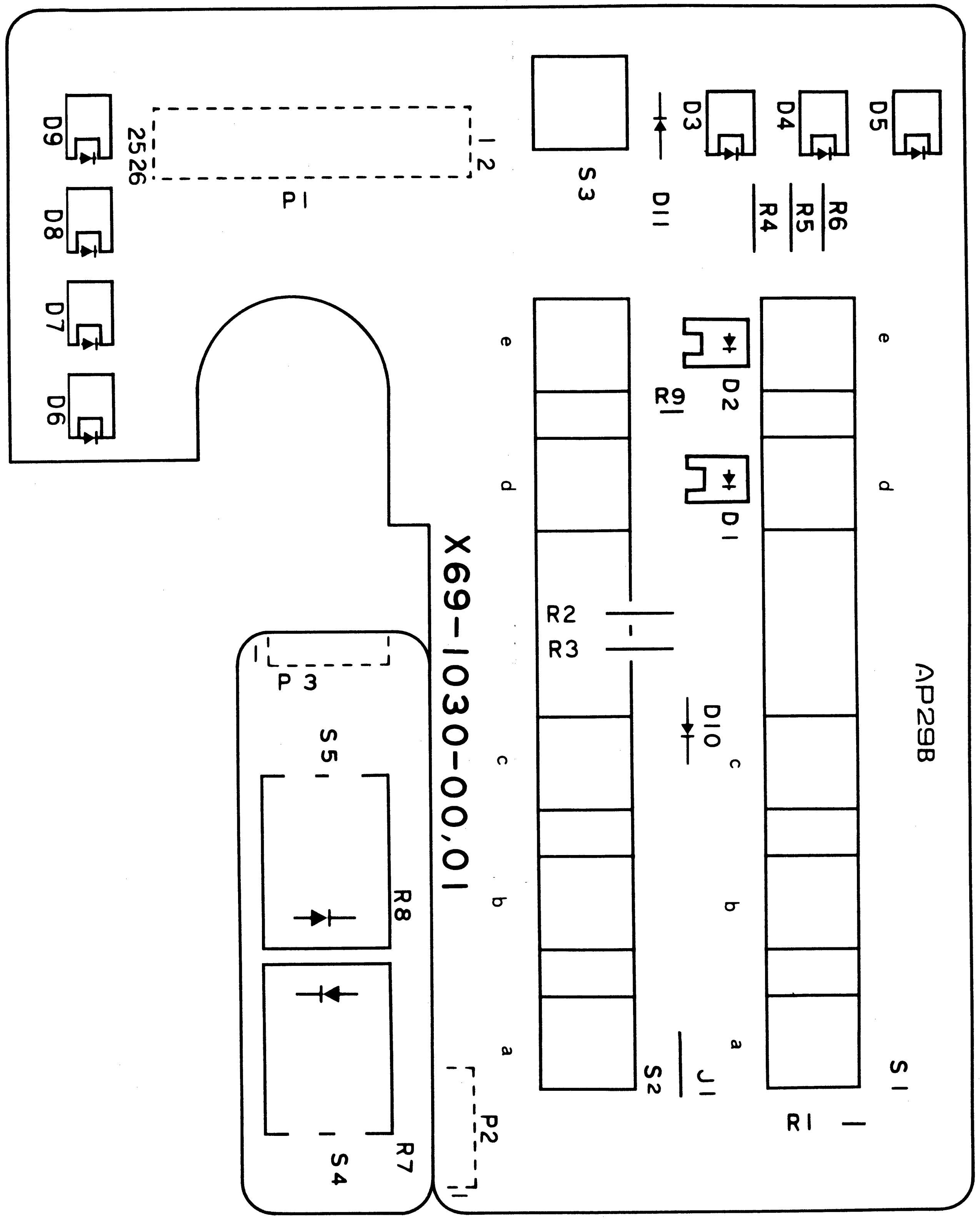

①
30.5 V
Approx. 20 kHz
9.5 V
②
11.6 V
8.4 V
③
0~24 V
41.6 V
(CHOP)
④
115 V
0~23 V
41 V
(CHOP)
0~11 V

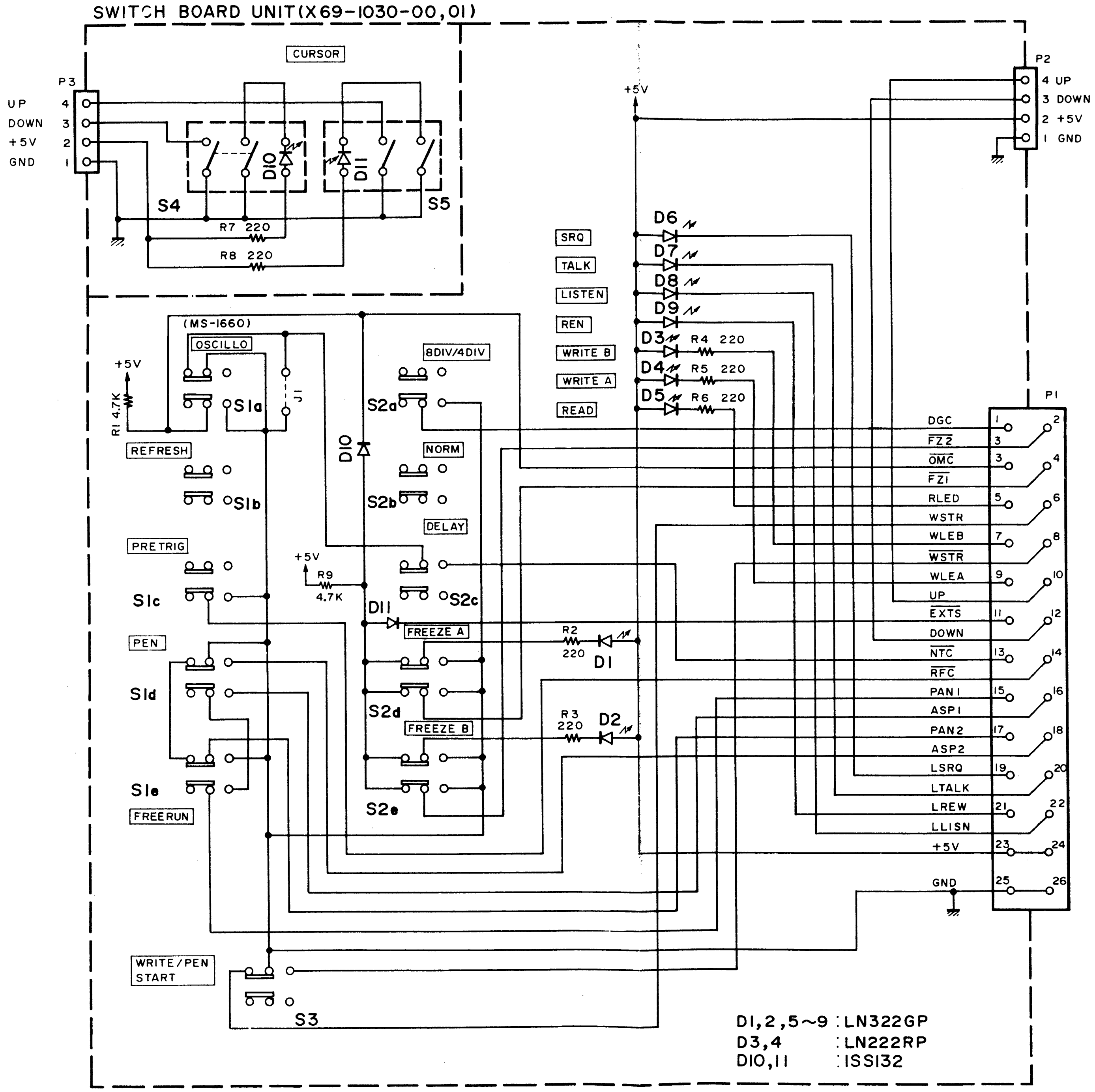
VR1	Requlated voltage adjustment
VR2	High voltage adjustment
VR3	Trace disappears point adjustment
TC1	Blanking adjustment


POWER SUPPLY UNIT (X68-1420-00)
Q1 : 2SB940A(R)
Q2 : 2SC2591(R)
Q3 : 2SA1111(Q)
Q4 : 2SD1263A(P)
Q5 : 2SC1505
Q6 : 2SC2271
Q7 : 2SD401A
Q8,13 : 2SC2331(Q,R)
Q9 : 2SA1309(Q,R)
Q10 : 2SA1210(S)
Q11,14 : 2SC2912(S)
Q12 : 2SC3315(C,D)
D1 : S2VB60
D2,3 : S1VB60
D4,6,7 : MTZ7.6JA
D5,13,21,22 : MTZ5.1JB
D8,15,19,20, 23-27 : 1SS132
D9 : Y16JA
D10 : W02-0401-05
D11,12 : V11-N
D16,17 : 1SS83
D18 : MTZ9.1JC
U1,2 : NJM4556D

P. C. BOARD/SCHEMATIC DIAGRAM

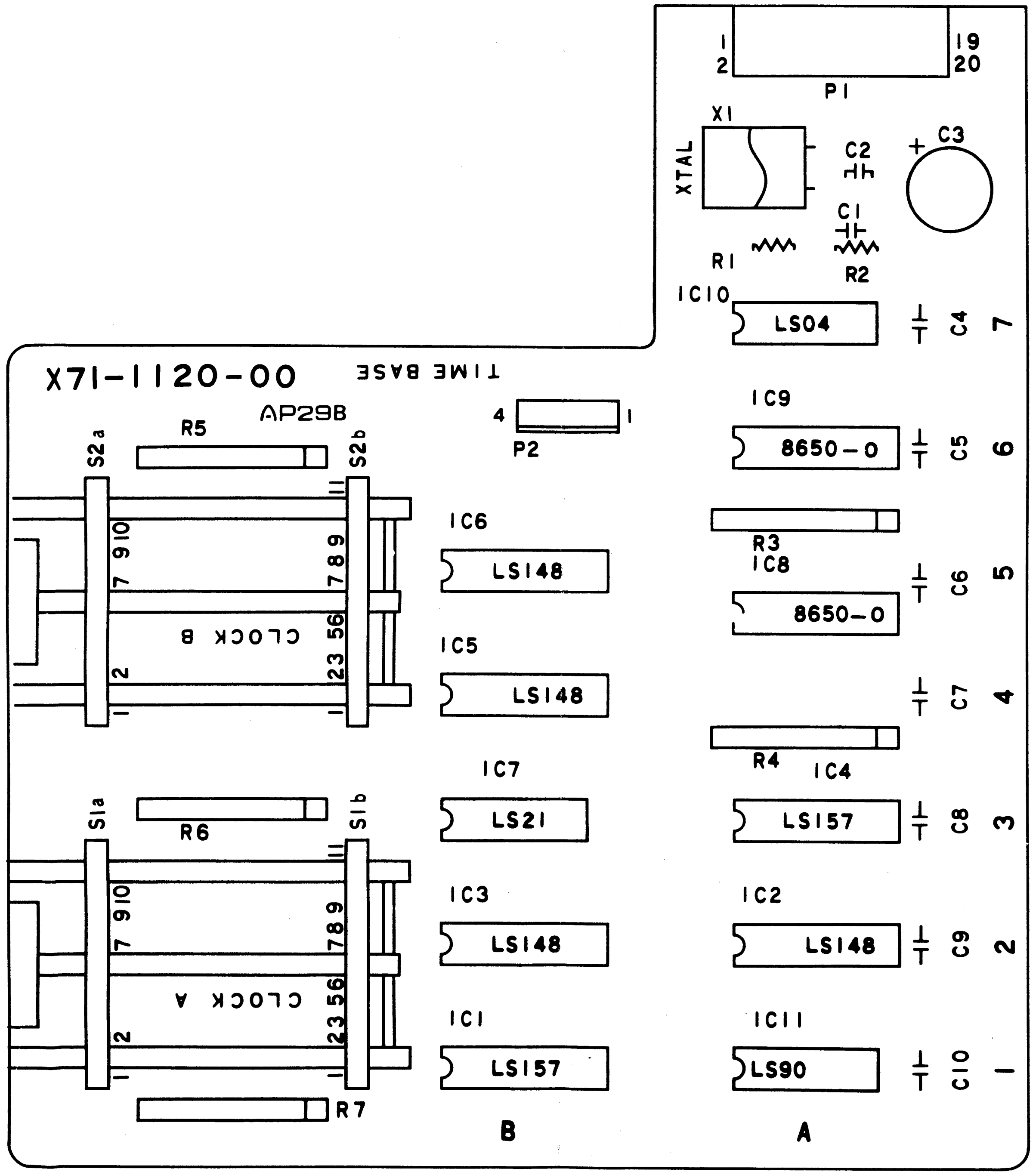
SWITCH BOARD UNIT (X69-1030 00)


D9
D8
D7
D6
2526
1 2
P1
S3
D11
D3
D4
D5
R4
R5
R6
R9
D2
D1
e
d
c
b
a
X69-1030-00,01
AP29B
R2
R3
D10
P 3
S5
R8
R7
S4
P2
S2
J1
S1
R1

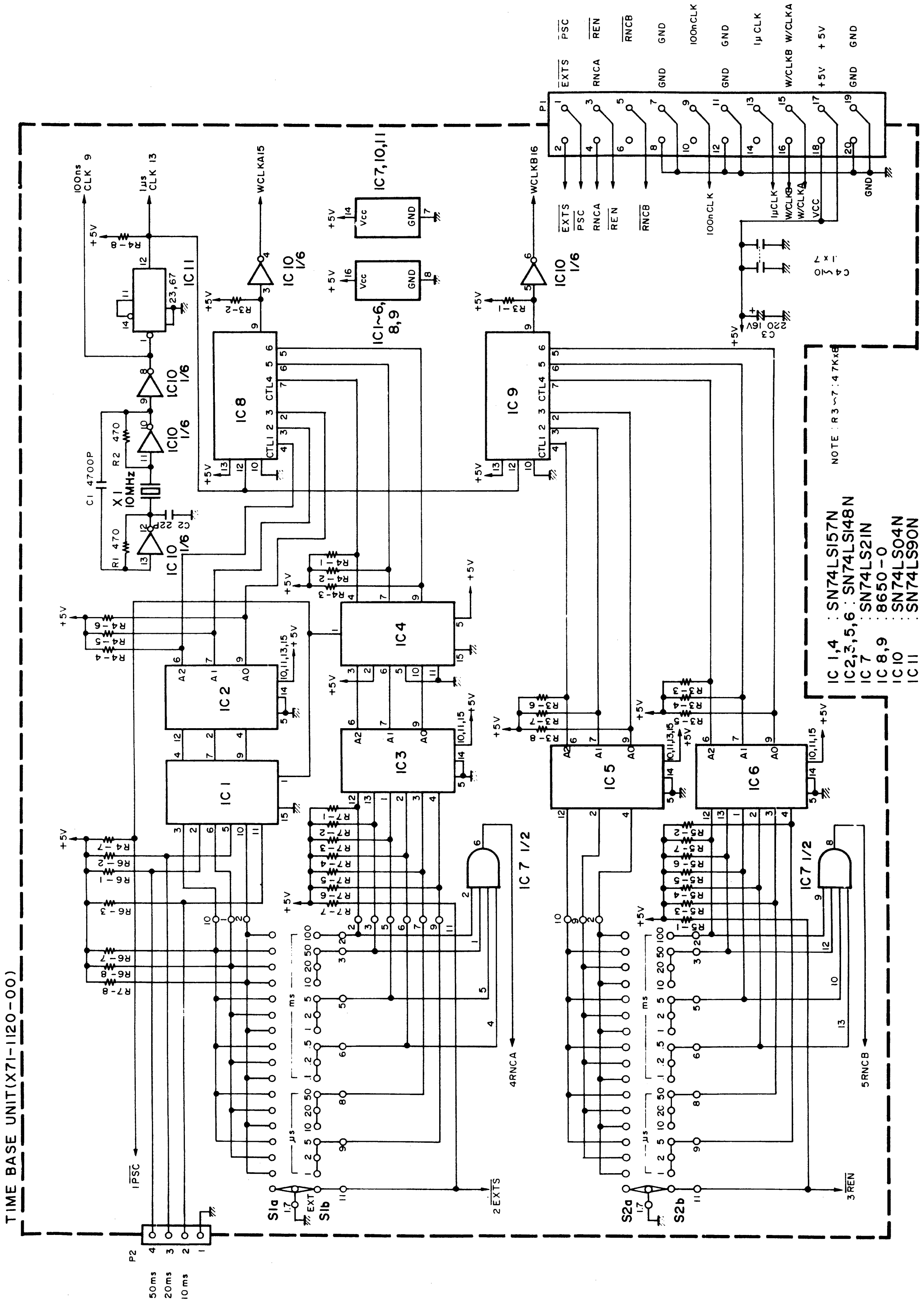

SWITCH BOARD UNIT(X69-1030-00,01)
CURSOR
P3
UP 4
DOWN 3
+5V 2
GND 1
S4
D10
D11
S5
R7 220
R8 220
+5V
P2
4 UP
3 DOWN
2 +5V
1 GND
SRQ
TALK
LISTEN
REN
WRITE B
WRITE A
READ
D6
D7
D8
D9
D3
R4 220
D4
R5 220
D5
R6 220
(MS-1660)
OSCILLO
+5V
R1 4.7K
S1a
J1
8DIV/4DIV
S2a
REFRESH
D10
NORM
S1b
S2b
DELAY
PRETRIG
+5V
R9
4.7K
S1c
S2c
D11
FREEZE A
R2
220
D1
PEN
S1d
S2d
FREEZE B
R3
220
D2
S1e
S2e
FREERUN
WRITE/PEN
START
S3
P1
DGC
FZ2
OMC
FZ1
RLED
WSTR
WLEB
WSTR
WLEA
UP
EXTS
DOWN
NTC
RFC
PAN1
ASP1
PAN2
ASP2
LSRQ
LTALK
LREW
LLISN
+5V
GND
1 2 3 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
D1,2,5~9 :LN322GP
D3,4 :LN222RP
D10,11 :1SS132

P. C. BOARD/SCHEMATIC DIAGRAM

TIME BASE UNIT (X71-1170-00)



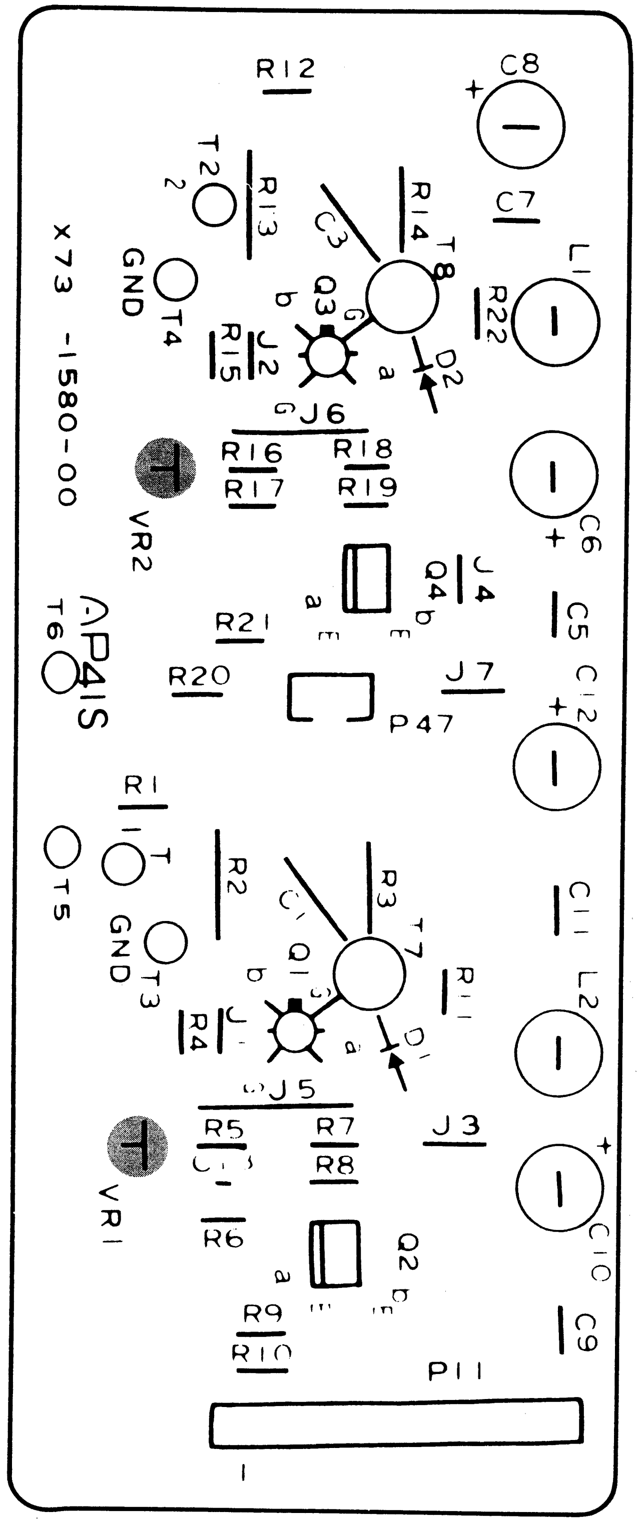
P1
1
2
19
20
X1
XTAL
C2
C3
C1
R1
R2
IC10
LS04
C4
7
IC9
8650-0
C5
6
P2
4
1
X71-1120-00
TIME BASE
AP29B
R5
S2a
S2b
CLOCK B
IC6
LS148
R3
IC8
8650-0
C6
5
IC5
LS148
C7
4
R4
IC7
LS21
IC4
LS157
C8
3
S1a
S1b
R6
IC3
LS148
IC2
LS148
C9
2
CLOCK A
IC1
LS157
IC11
LS90
C10
1
R7
B
A

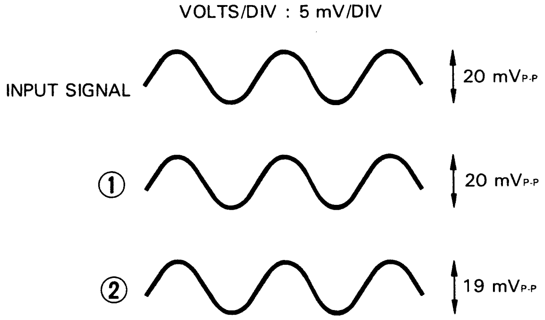


P1
EXTS
PSC
RNCA
REN
RNCB
GND
100nCLK
1μCLK
W/CLKB
W/CLKA
+5V
VCC
100ns CLK 9
1μs CLK 13
WCLKA15
WCLKB16
IC7,10,11
IC1-6, 8,9
IC10 1/6
IC11
IC8
IC9
X1 10MHz
C1 4700P
C2 22P
R1 470
R2 470
C3 220 16V
C4~7 .1
IC4
IC2
IC1
IC3
IC5
IC6
IC7 1/2
4RNCA
5RNCB
2EXTS
3REN
1PSC
S1a
S1b
S2a
S2b
EXT
ms
μs
P2
50ms
20ms
10ms
TIME BASE UNIT(X71-1120-00)
NOTE R3~7:4.7kx8
IC 1,4 : SN74LS157N
IC2,3,5,6 : SN74LS148N
IC 7 : SN74LS21N
IC 8,9 : 8650-0
IC10 : SN74LS04N
IC11 : SN74LS90N

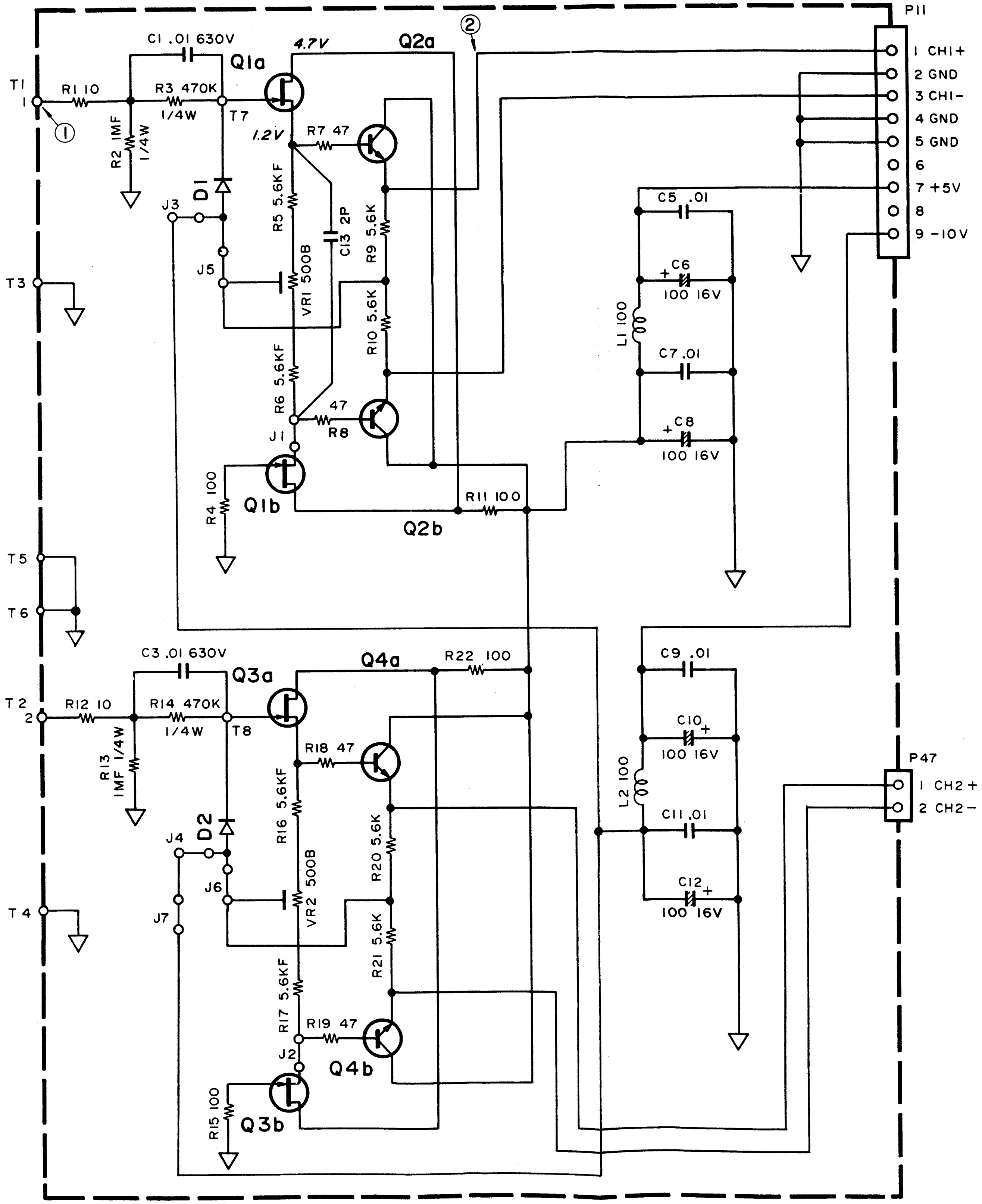
P. C. BOARD/SCHEMATIC DIAGRAM

VERTICAL HEAD UNIT (X-73-1580-00)


R12
C8
T2
R13
C3
R14
T8
C7
L1
GND
T4
Q3
R22
x73 -1580-00
R15
J2
D2
J6
R16
R18
R17
R19
VR2
C6
J4
Q4
AP41S
T6
R21
C5
R20
J7
C12
P47
R1
T1
R2
R3
T7
T5
GND
T3
Q1
R11
C11
L2
R4
D1
J5
R5
R7
J3
R8
VR1
C10
R6
Q2
R9
R10
C9
P11
1



VERTICAL HEAD UNIT (X73-1580-00)

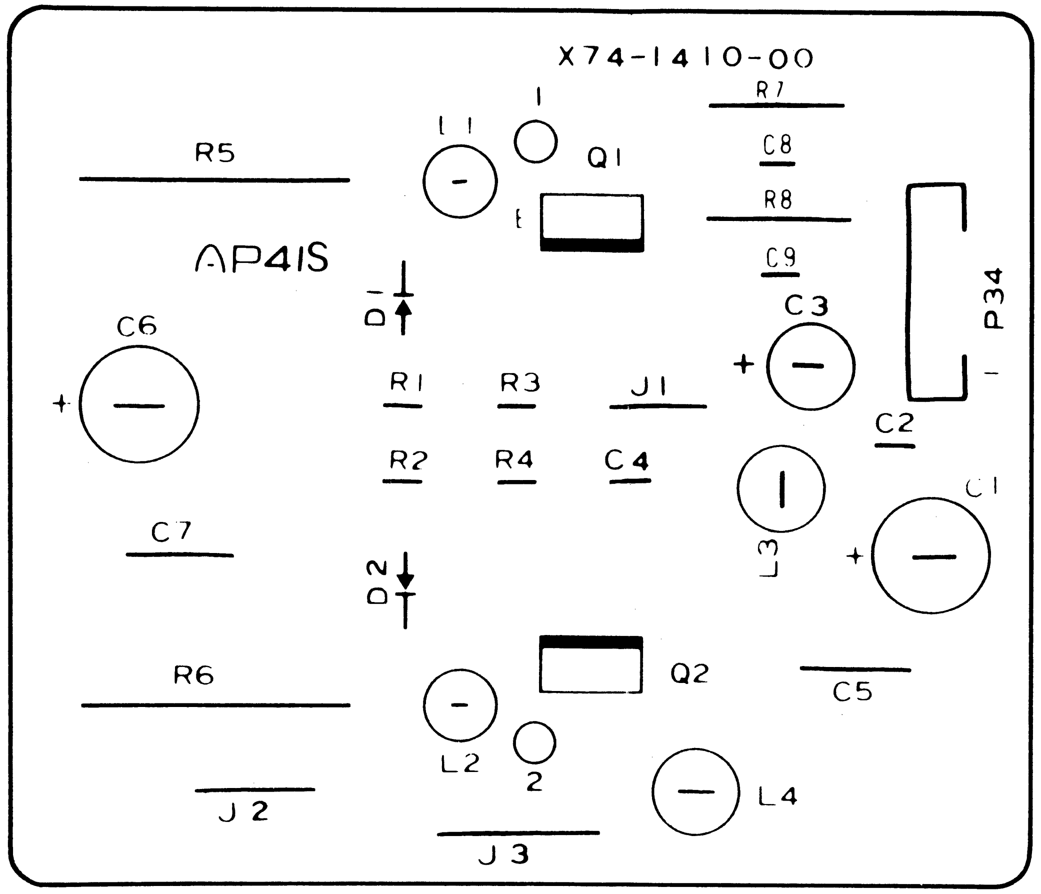

P11
1 CH1+
2 GND
3 CH1−
4 GND
5 GND
6
7 +5V
8
9 −10V
C1 .01 630V
4.7V
Q2a
②
Q1a
T1
1
R1 10
R3 470K
1/4W
T7
①
R2 1MF 1/4W
1.2V
R7 47
D1
J3
J5
R5 5.6KF
VR1 500B
C13 2P
R9 5.6K
R10 5.6K
T3
C5 .01
C6 100 16V
L1 100
C7 .01
C8 100 16V
R6 5.6KF
47
R8
J1
R4 100
Q1b
R11 100
Q2b
T5
T6
C3 .01 630V
Q3a
Q4a
R22 100
T2
2
R12 10
R14 470K
1/4W
T8
R13 1MF 1/4W
R18 47
C9 .01
C10 100 16V
L2 100
P47
1 CH2+
2 CH2−
C11 .01
D2
J4
R16 5.6KF
R20 5.6K
J6
VR2 500B
C12 100 16V
T4
J7
R21 5.6K
R17 5.6KF
R19 47
J2
Q4b
R15 100
Q3b

Q1,3 : DN1901
Q2,4 : 2SC3066(F,G)
D1,2 : 1S1544A

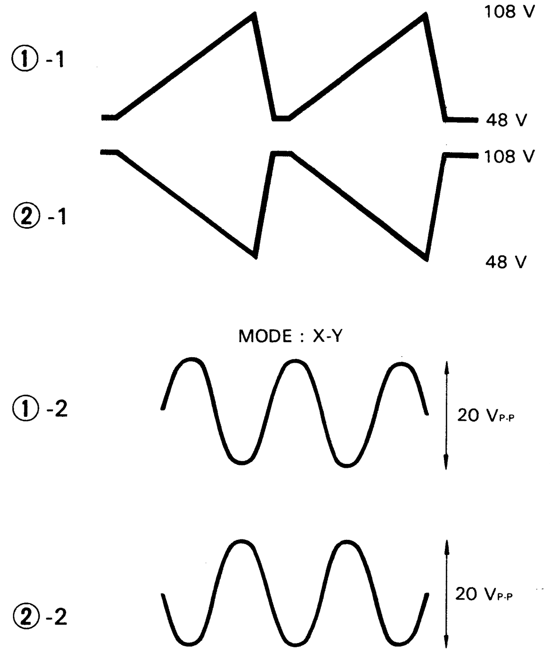
VR1 CH1 × 5 GAIN balance adjustment
VR2 CH2 × 5 GAIN balance adjustment

P. C. BOARD/SCHEMATIC DIAGRAM

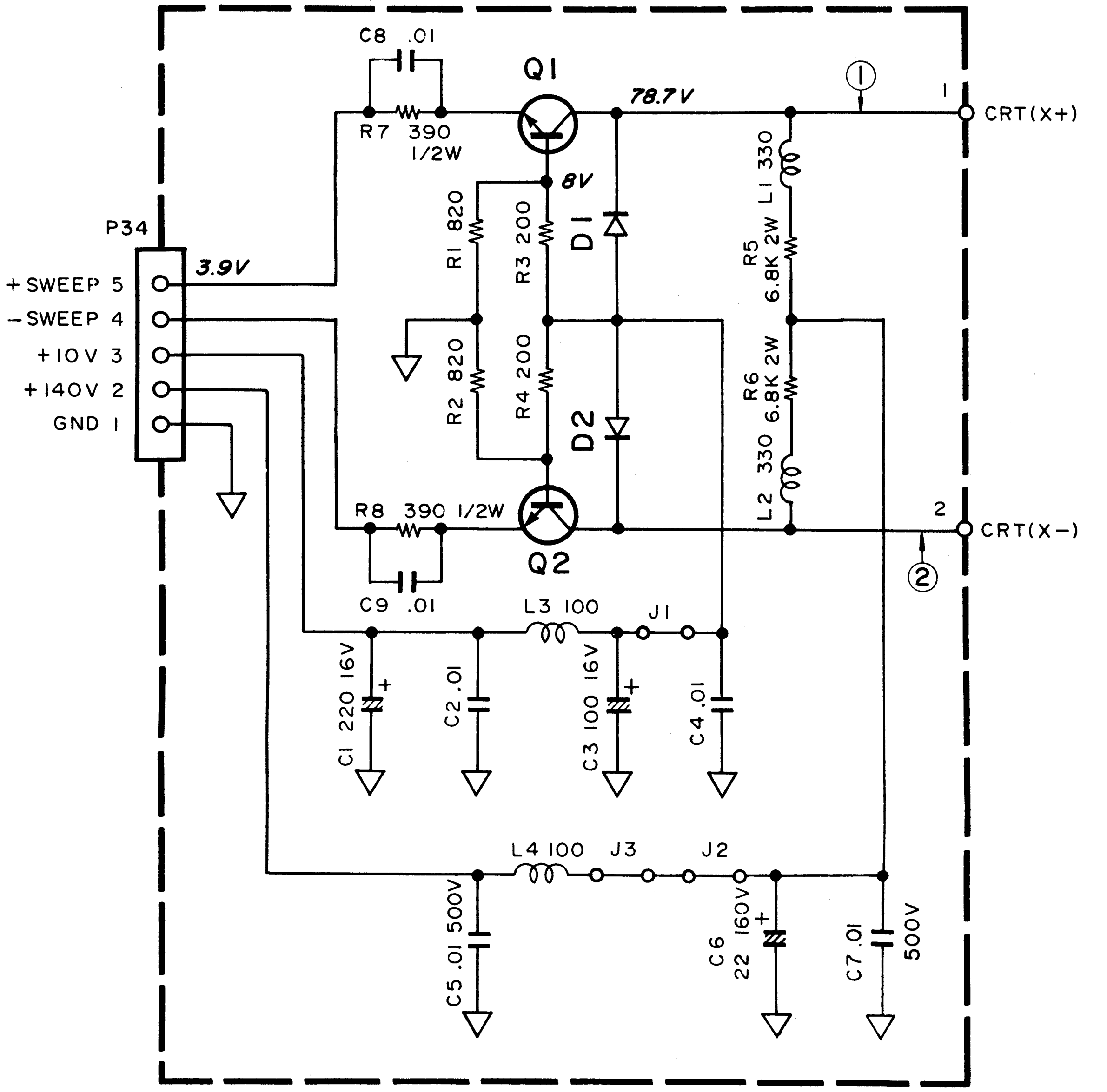
HORIZONTAL OUTPUT UNIT (X74-1440-00)



X74-1410-00
AP41S
R5
R6
R7
R8
C1
C2
C3
C4
C5
C6
C7
C8
C9
L1
L2
L3
L4
Q1
Q2
D1
D2
R1
R2
R3
R4
J1
J2
J3
P34
1
2



HORIZONTAL OUTPUT AMP UNIT (X74-1410-00)

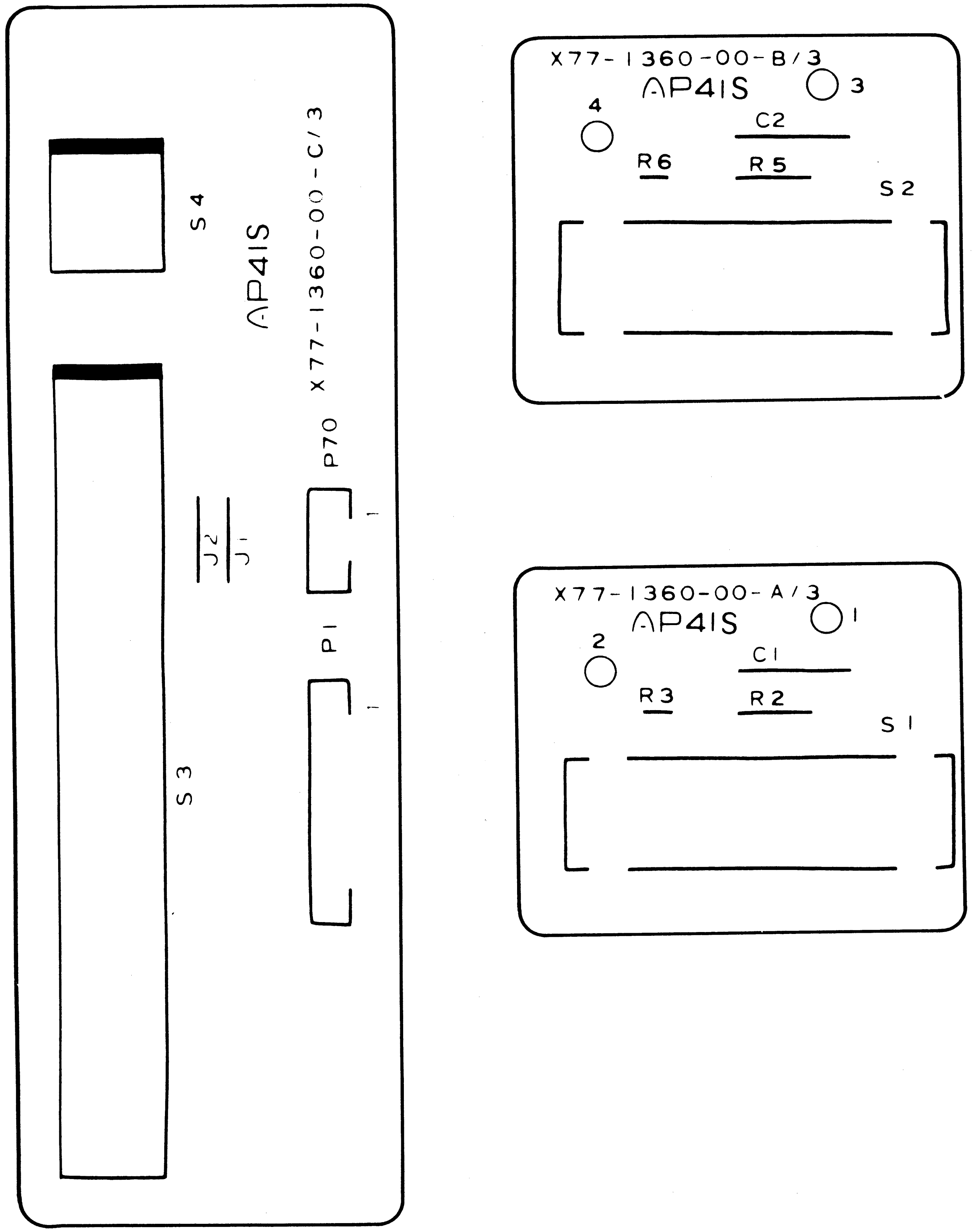


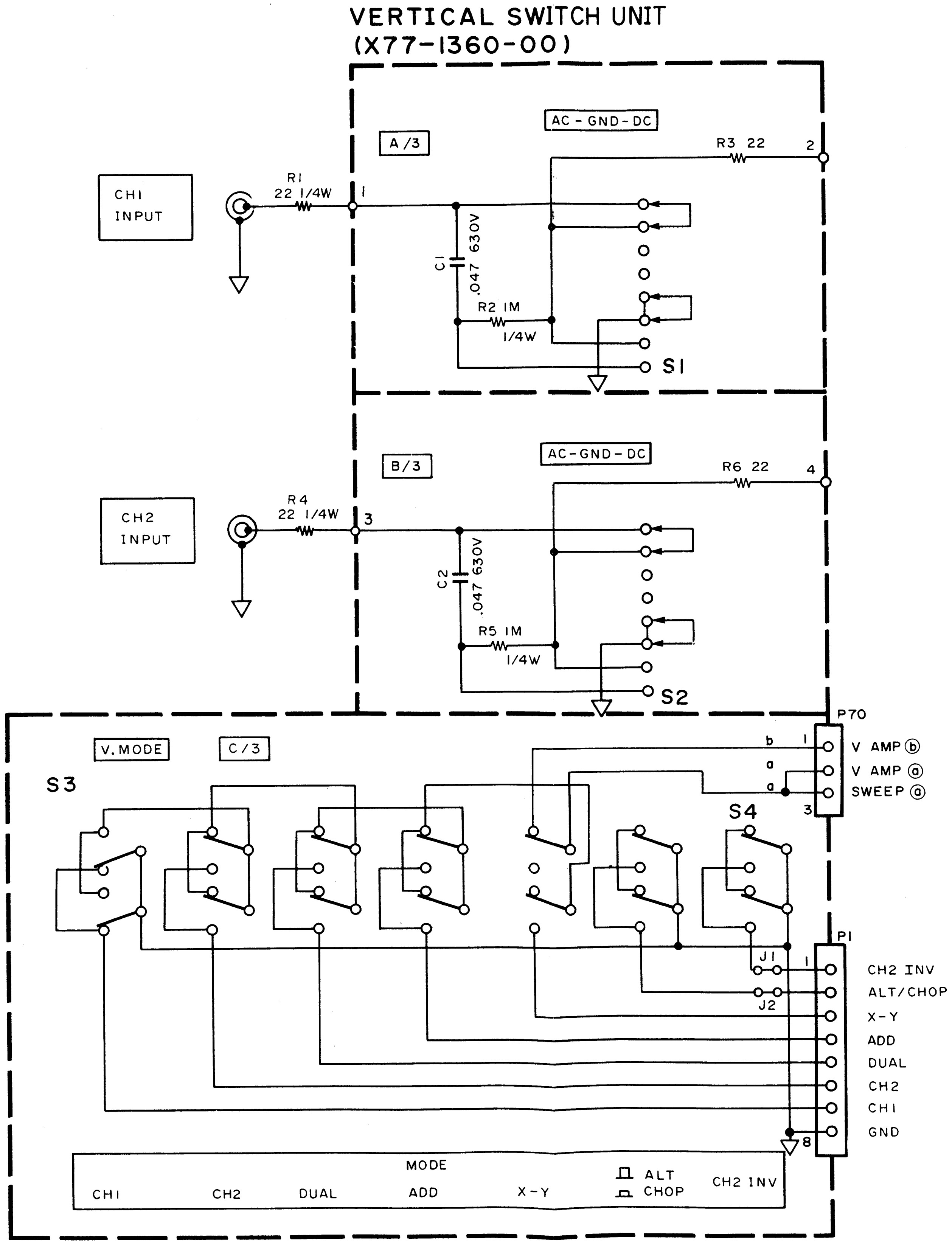
C8 .01
R7 390 1/2W
Q1
78.7V
8V
①
1
CRT(X+)
L1 330
R5 6.8K 2W
R6 6.8K 2W
L2 330
R1 820
R3 200
D1
R2 820
R4 200
D2
P34
3.9V
+SWEEP 5
−SWEEP 4
+10V 3
+140V 2
GND 1
R8 390 1/2W
Q2
C9 .01
2
CRT(X−)
②
L3 100
J1
C1 220 16V
C2 .01
C3 100 16V
C4 .01
L4 100
J3
J2
C5 .01 500V
C6 22 160V
C7 .01 500V

Q1,2 :2SC1505
D1,2 :1SS83

P. C. BOARD/SCHEMATIC DIAGRAM

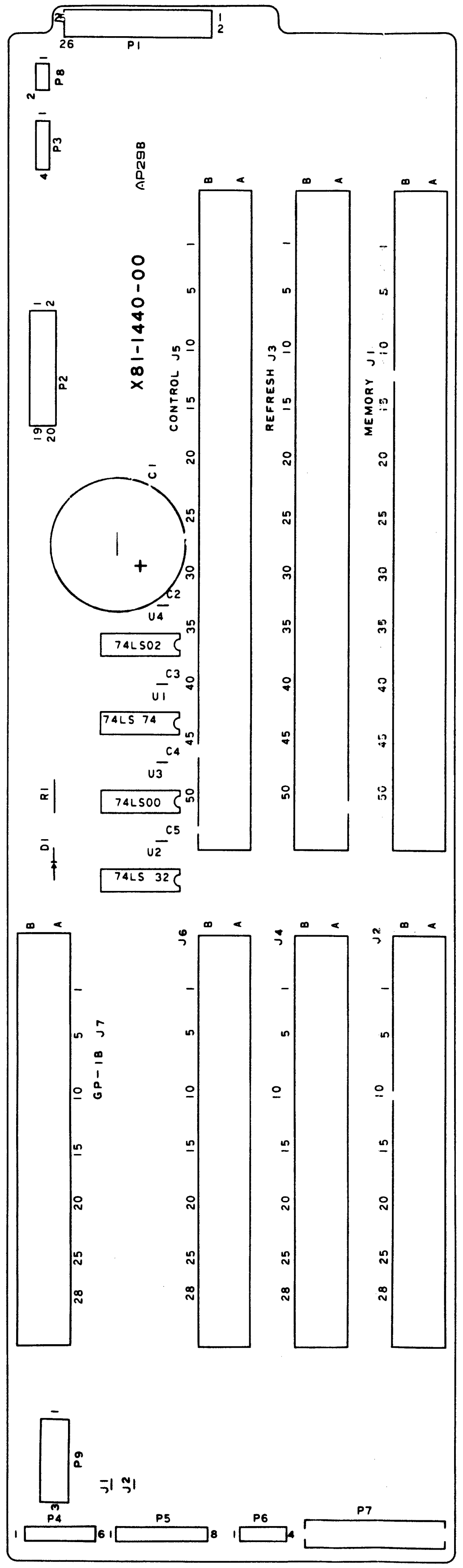
VERTICAL SWITCH UNIT (X77-1360-00)

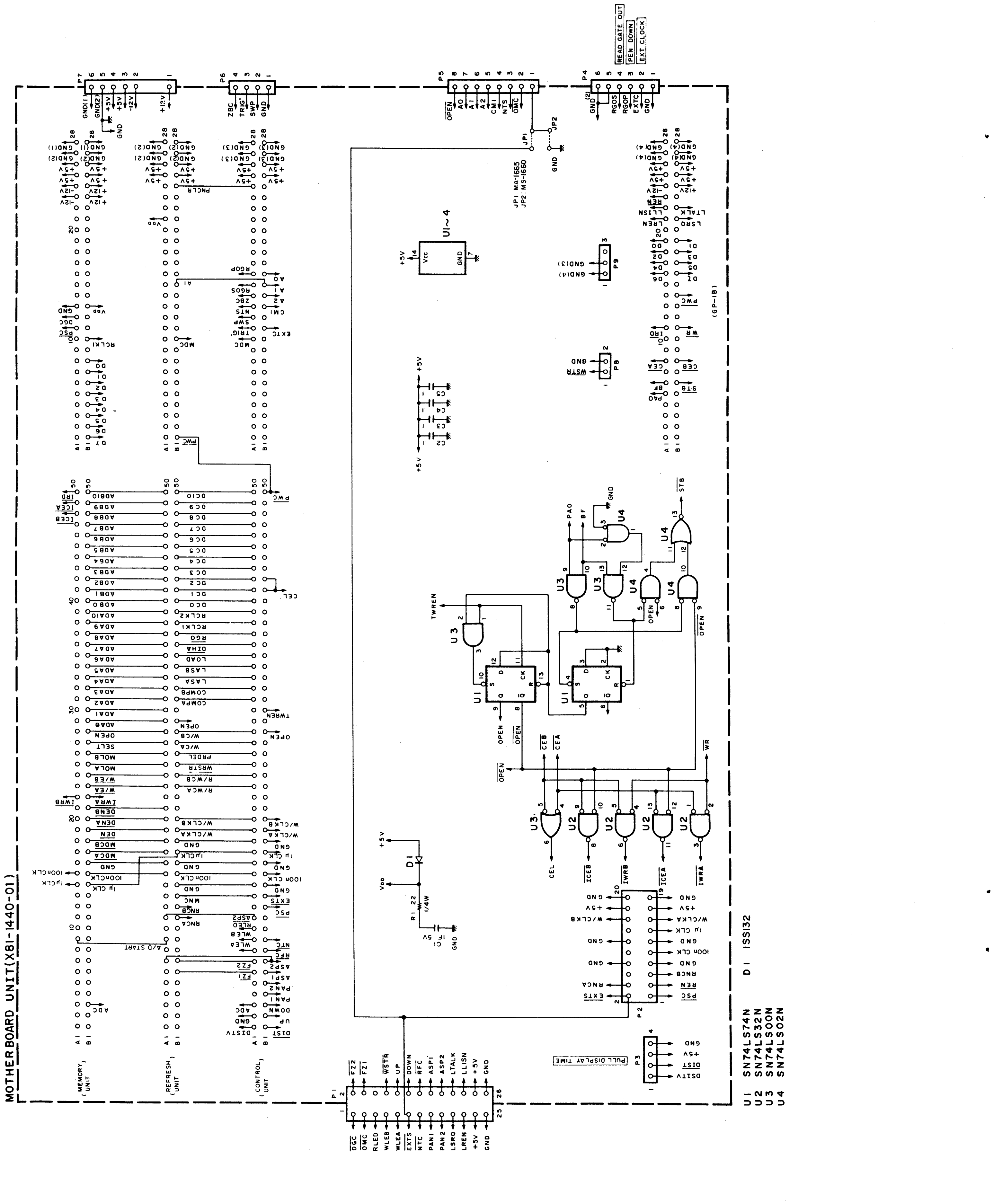

S4
AP4IS
X77-1360-00-C/3
P70
J2
J1
P1
S3
1
1
X77-1360-00-B/3
AP4IS
4
3
C2
R6
R5
S2
X77-1360-00-A/3
AP4IS
2
1
C1
R3
R2
S1


VERTICAL SWITCH UNIT
(X77-1360-00)
A/3
AC-GND-DC
CH1 INPUT
R1 22 1/4W
1
C1 .047 630V
R2 1M 1/4W
R3 22
2
S1
B/3
AC-GND-DC
CH2 INPUT
R4 22 1/4W
3
C2 .047 630V
R5 1M 1/4W
R6 22
4
S2
V.MODE
C/3
S3
S4
P70
b
a
a
1
3
V AMP ⓑ
V AMP ⓐ
SWEEP ⓐ
P1
J1
J2
1
8
CH2 INV
ALT/CHOP
X-Y
ADD
DUAL
CH2
CH1
GND
MODE
CH1
CH2
DUAL
ADD
X-Y
ALT
CHOP
CH2 INV

MOTHER BOARD UNIT (X81-1440-00)

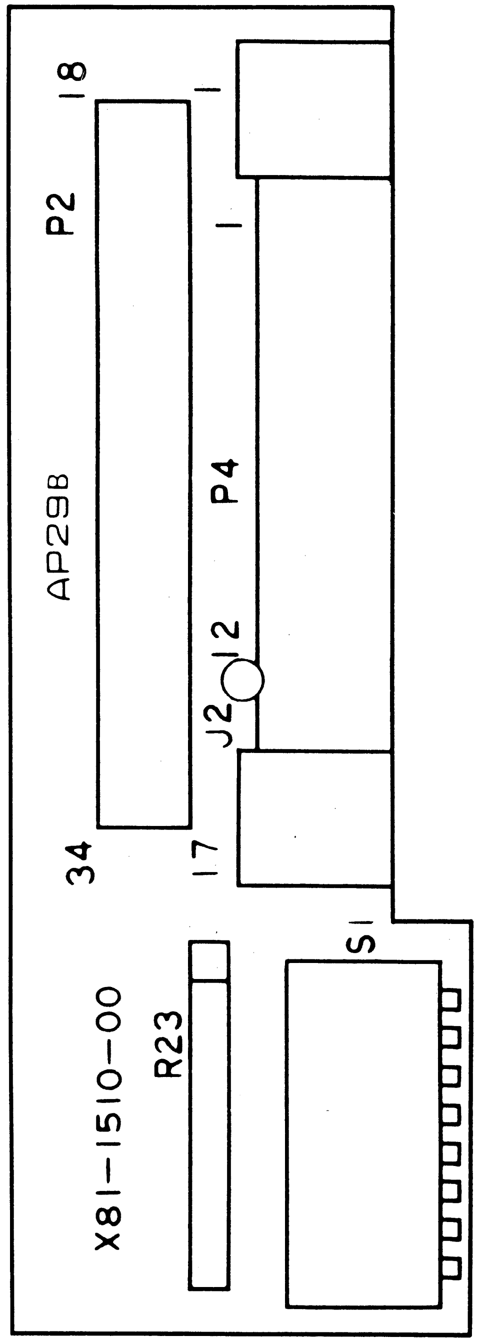
P. C. BOARD/SCHEMATIC DIAGRAM


P1
26
1
2
P8
P3
P2
AP298
X81-1440-00
CONTROL J5
REFRESH J3
MEMORY J1
C1
C2
U4
74LS02
C3
U1
74LS 74
C4
U3
74LS00
C5
U2
74LS 32
R1
D1
GP-1B J7
J6
J4
J2
P9
J1 J2
P4
P5
P6
P7

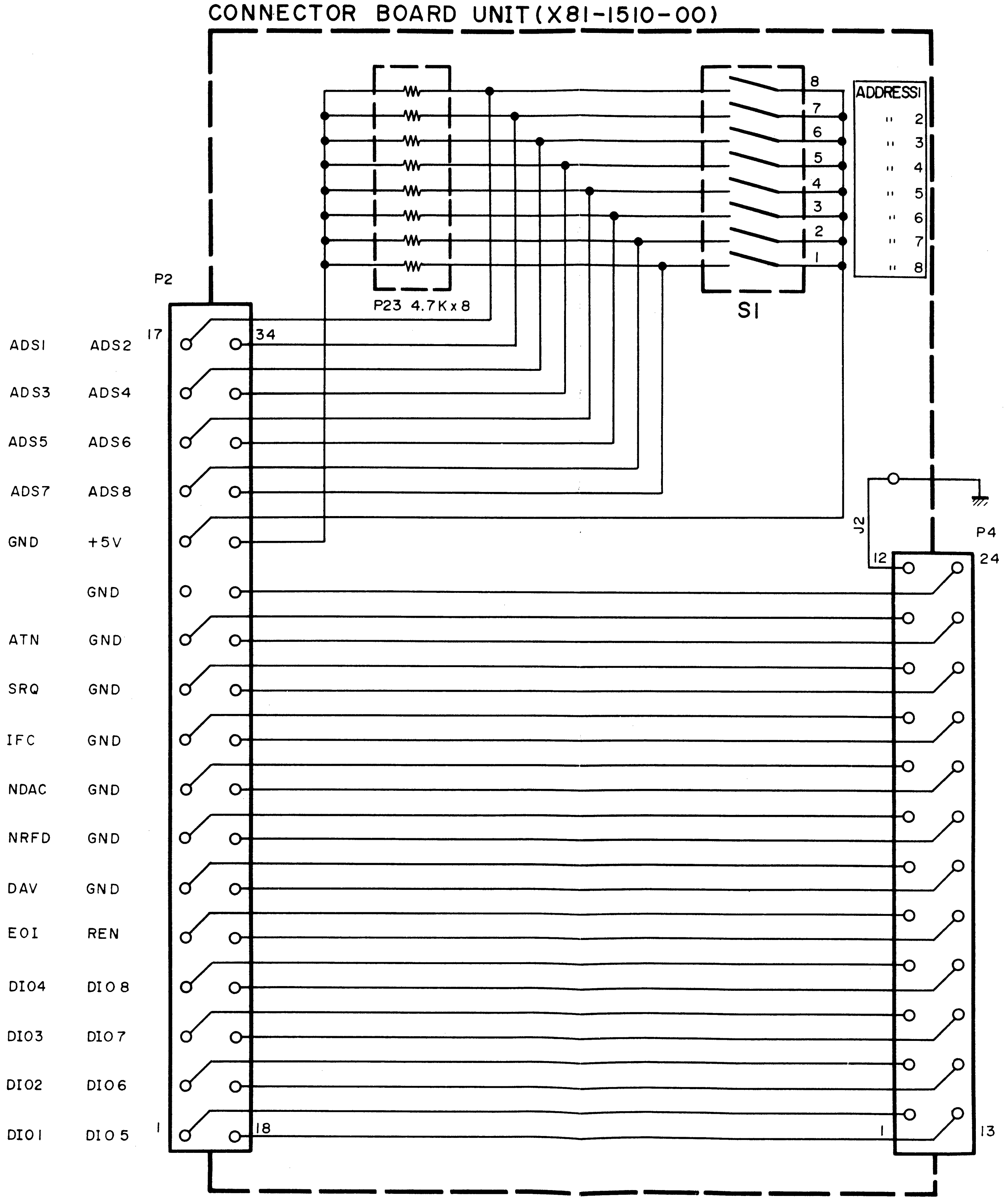

MOTHER BOARD UNIT(X81-1440-01)
READ GATE OUT
PEN DOWN
EXT CLOCK
P7
P6
P5
P4
P1
P2
P3
P8
P9
JP1 MA-1665
JP2 MS-1660
MEMORY UNIT
REFRESH UNIT
CONTROL UNIT
PULL DISPLAY TIME
U1~4
U1 SN74LS74N
U2 SN74LS32N
U3 SN74LS00N
U4 SN74LS02N
D1 1SS132

P. C. BOARD/SCHEMATIC DIAGRAM

CONNECTOR BOARD UNIT (X81-1510-00)

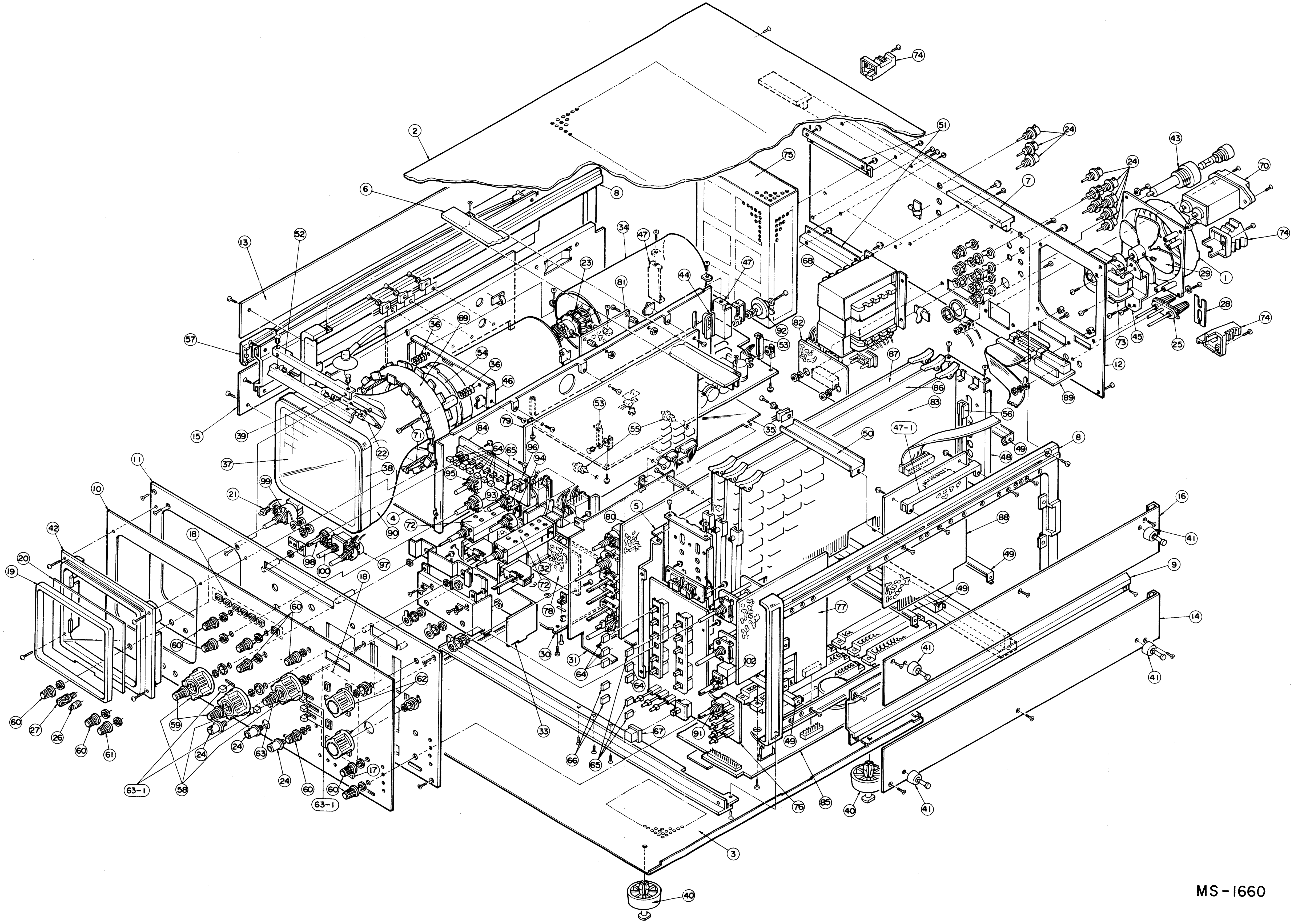


P2
18
1
1
AP29B
P4
12
J2
34
17
S1
X81-1510-00
R23



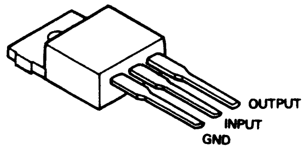
CONNECTOR BOARD UNIT(X81-1510-00)
P23 4.7K x 8
S1
8
7
6
5
4
3
2
1
ADDRESS1
" 2
" 3
" 4
" 5
" 6
" 7
" 8
P2
17
34
1
18
ADS1
ADS2
ADS3
ADS4
ADS5
ADS6
ADS7
ADS8
GND
+5V
GND
ATN
GND
SRQ
GND
IFC
GND
NDAC
GND
NRFD
GND
DAV
GND
EOI
REN
DIO4
DIO8
DIO3
DIO7
DIO2
DIO6
DIO1
DIO5
J2
12
P4
24
1
13

DISASSEMBLY

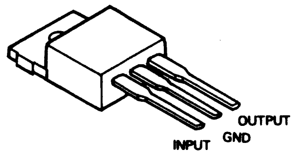

74
2
24
51
43
70
75
24
7
6
8
34
47
13
52
23
81
47
44
68
74
29
1
28
36
69
54
36
46
57
82
87
92
53
73
45
25
74
12
86
89
83
56
15
39
79
53
55
35
50
47-1
71
84
64
65
96
94
22
37
38
95
93
49
48
8
11
10
99
21
4
90
72
80
5
88
16
41
42
18
97
98
100
72
32
49
9
20
19
18
60
60
78
77
14
30
31
64
102
41
62
41
33
67
91
60
27
26
60
61
59
24
24
63
17
66
65
49
85
76
40
41
63-1
58
24
60
60
63-1
3
40

MS-1660

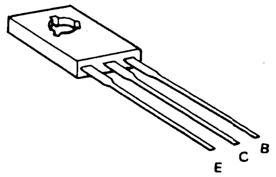
SEMICONDUCTORS


OUTPUT
INPUT
GND

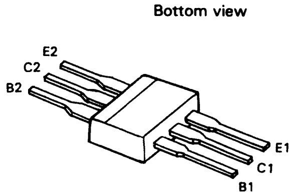
LM7905CT


OUTPUT
INPUT
GND

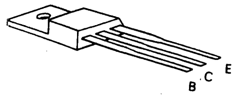
µA78M05UC
MC78M05CT



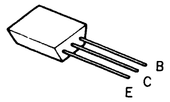
2SA1210 (S)
2SC2912 (S)


Bottom view
E2
C2
B2
E1
C1
B1

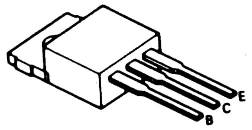
2SC3066 (F, G)



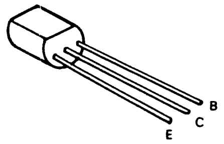
2SB940A (P)
2SD1263A (P)



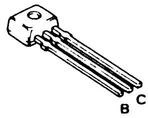
2SA1309 (Q, R)
2SA1323 (B, C)
2SC3311 (Q, R)
2SC3315 (C, D)



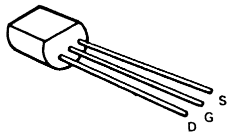
2SA1111 (Q)
2SC2591 (Q)
2SC1505
2SD401A



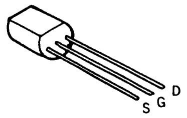
2SA684 (R)
2SA838 (C)
2SA733 (Q)
2SC1973 (T)
2SC1815 (GR)
2SC1384 (R)
2SC1047 (C)
2SC945 (P)
2SC2271



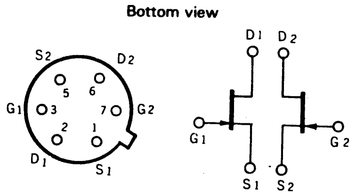
2SA1175 (F)
2SC2786 (K)
2SC2785 (F)



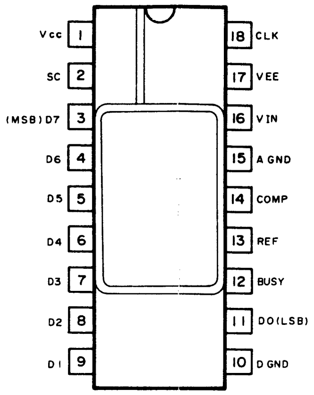
2SK117 (GR)



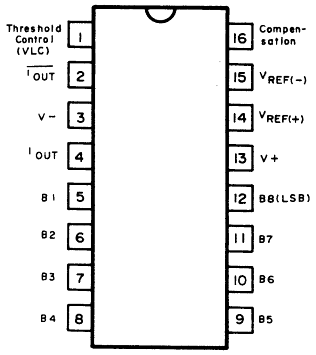
2SK30A (O)


Bottom view
S2
D2
G1
G2
D1
S1
1
2
3
5
6
7
D1
D2
G1
G2
S1
S2

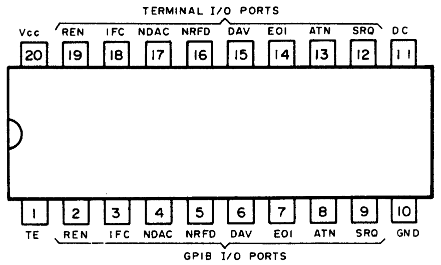
DN1901


Vcc 1
SC 2
(MSB) D7 3
D6 4
D5 5
D4 6
D3 7
D2 8
D1 9
10 D GND
11 D0(LSB)
12 BUSY
13 REF
14 COMP
15 A GND
16 VIN
17 VEE
18 CLK

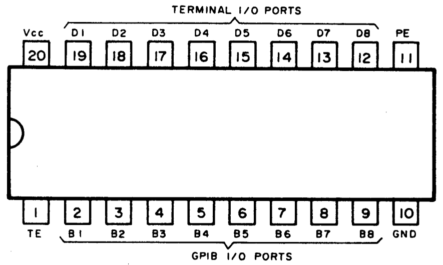
TDC1001J


Threshold Control (VLC) 1
IOUT 2
V− 3
IOUT 4
B1 5
B2 6
B3 7
B4 8
9 B5
10 B6
11 B7
12 B8(LSB)
13 V+
14 VREF(+)
15 VREF(−)
16 Compensation

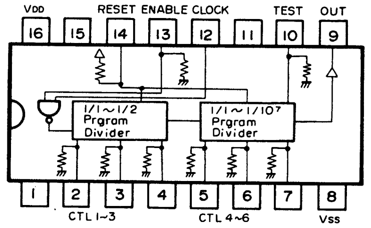
DAC-08HP


TERMINAL I/O PORTS
Vcc 20
REN 19
IFC 18
NDAC 17
NRFD 16
DAV 15
EOI 14
ATN 13
SRQ 12
DC 11
1 TE
2 REN
3 IFC
4 NDAC
5 NRFD
6 DAV
7 EOI
8 ATN
9 SRQ
10 GND
GPIB I/O PORTS

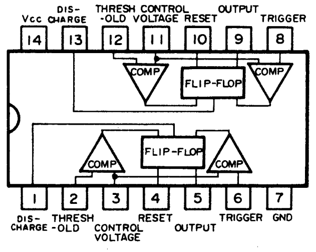
SN75161N


TERMINAL I/O PORTS
Vcc 20
D1 19
D2 18
D3 17
D4 16
D5 15
D6 14
D7 13
D8 12
PE 11
1 TE
2 B1
3 B2
4 B3
5 B4
6 B5
7 B6
8 B7
9 B8
10 GND
GPIB I/O PORTS

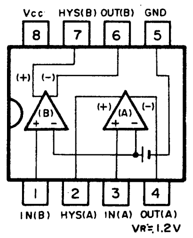
SN75160AN


VDD 16
15
RESET 14
ENABLE 13
CLOCK 12
11
TEST 10
OUT 9
1/1~1/2 Prgram Divider
1/1~1/10⁷ Prgram Divider
1 2 3 CTL 1~3
4 5 6 CTL 4~6
7
8 Vss

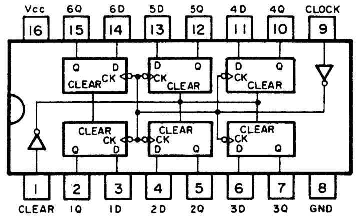
8650-O


Vcc 14
DIS-CHARGE 13
THRESH-OLD 12
CONTROL VOLTAGE 11
RESET 10
OUTPUT 9
TRIGGER 8
COMP
FLIP-FLOP
1 DIS-CHARGE
2 THRESH-OLD
3 CONTROL VOLTAGE
4 RESET
5 OUTPUT
6 TRIGGER
7 GND

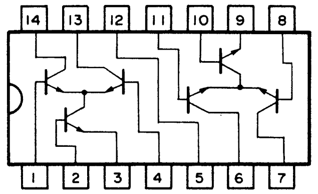
LM556CN


Vcc 8
HYS(B) 7
OUT(B) 6
GND 5
(+) (−)
(B)
(A)
1 IN(B)
2 HYS(A)
3 IN(A)
4 OUT(A)
VR≒1.2V

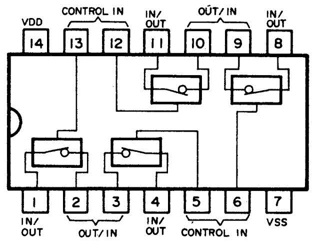
MB3761M


Vcc 16
6Q 15
6D 14
5D 13
5Q 12
4D 11
4Q 10
CLOCK 9
Q D CK CLEAR
1 CLEAR
2 1Q
3 1D
4 2D
5 2Q
6 3D
7 3Q
8 GND

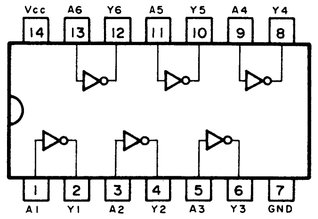
MC74HC174N


14 13 12 11 10 9 8
1 2 3 4 5 6 7

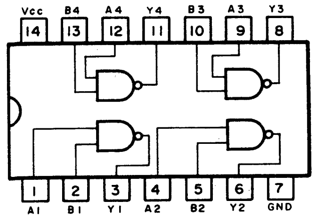
CA3102E


VDD 14
CONTROL IN 13 12
IN/OUT 11
OUT/IN 10 9
IN/OUT 8
1 IN/OUT
2 3 OUT/IN
4 IN/OUT
5 6 CONTROL IN
7 VSS

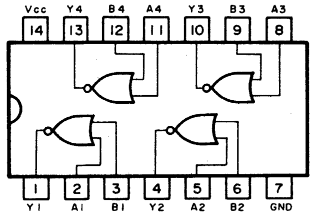
MC14066BCP


Vcc 14
A6 13
Y6 12
A5 11
Y5 10
A4 9
Y4 8
1 A1
2 Y1
3 A2
4 Y2
5 A3
6 Y3
7 GND

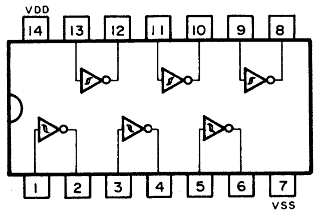
TC40H004P


Vcc 14
B4 13
A4 12
Y4 11
B3 10
A3 9
Y3 8
1 A1
2 B1
3 Y1
4 A2
5 B2
6 Y2
7 GND

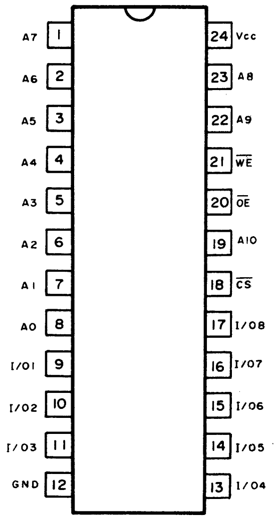
TC40H000P


Vcc 14
Y4 13
B4 12
A4 11
Y3 10
B3 9
A3 8
1 Y1
2 A1
3 B1
4 Y2
5 A2
6 B2
7 GND

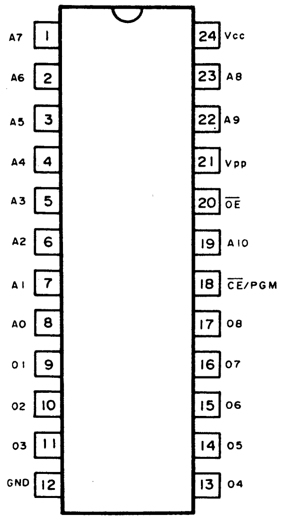
TC40H002P


VDD 14
13 12 11 10 9 8
1 2 3 4 5 6
7 VSS

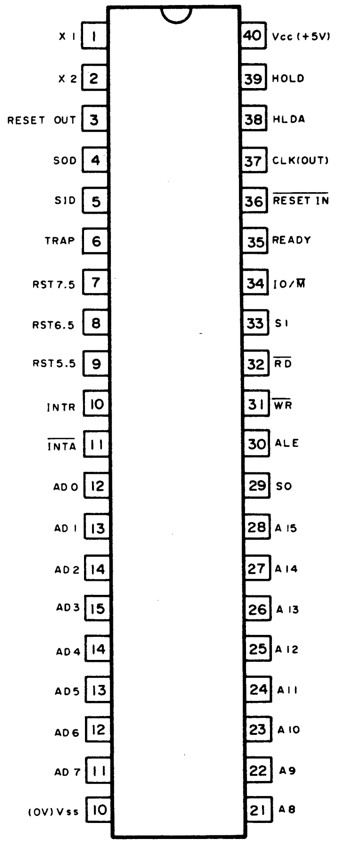
MC14584BCT


A7 1
A6 2
A5 3
A4 4
A3 5
A2 6
A1 7
A0 8
I/O1 9
I/O2 10
I/O3 11
GND 12
13 I/O4
14 I/O5
15 I/O6
16 I/O7
17 I/O8
18 CS
19 A10
20 OE
21 WE
22 A9
23 A8
24 Vcc

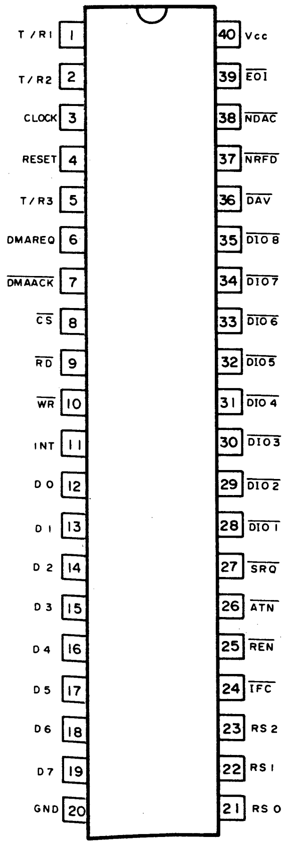
MB8416-20LP-G-RA


A7 1
A6 2
A5 3
A4 4
A3 5
A2 6
A1 7
A0 8
O1 9
O2 10
O3 11
GND 12
13 O4
14 O5
15 O6
16 O7
17 O8
18 CE/PGM
19 A10
20 OE
21 Vpp
22 A9
23 A8
24 Vcc

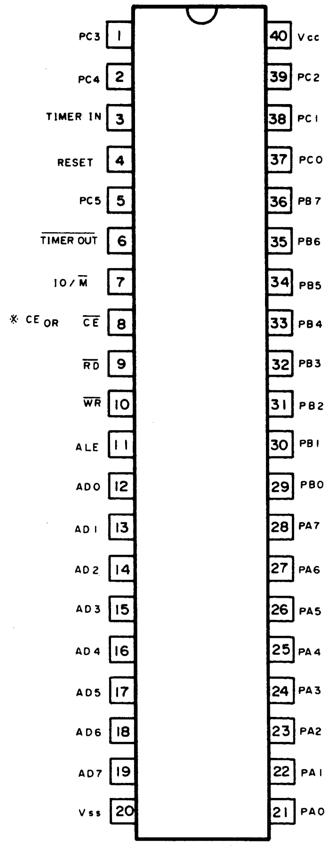
MB8516ZC


X1 1
X2 2
RESET OUT 3
SOD 4
SID 5
TRAP 6
RST7.5 7
RST6.5 8
RST5.5 9
INTR 10
INTA 11
AD0 12
AD1 13
AD2 14
AD3 15
AD4 14
AD5 13
AD6 12
AD7 11
(0V) Vss 10
21 A8
22 A9
23 A10
24 A11
25 A12
26 A13
27 A14
28 A15
29 S0
30 ALE
31 WR
32 RD
33 S1
34 IO/M
35 READY
36 RESET IN
37 CLK(OUT)
38 HLDA
39 HOLD
40 Vcc (+5V)

µPD8085AC

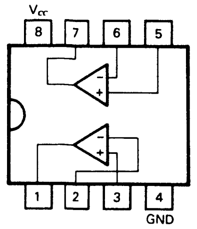

T/R1 1
T/R2 2
CLOCK 3
RESET 4
T/R3 5
DMAREQ 6
DMAACK 7
CS 8
RD 9
WR 10
INT 11
D0 12
D1 13
D2 14
D3 15
D4 16
D5 17
D6 18
D7 19
GND 20
21 RS0
22 RS1
23 RS2
24 IFC
25 REN
26 ATN
27 SRQ
28 DIO1
29 DIO2
30 DIO3
31 DIO4
32 DIO5
33 DIO6
34 DIO7
35 DIO8
36 DAV
37 NRFD
38 NDAC
39 EOI
40 Vcc

µPD7210C

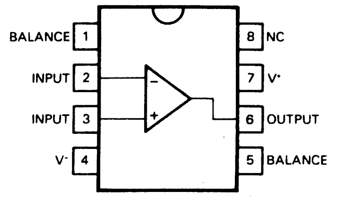

PC3 1
PC4 2
TIMER IN 3
RESET 4
PC5 5
TIMER OUT 6
IO/M 7
※ CE OR CE 8
RD 9
WR 10
ALE 11
AD0 12
AD1 13
AD2 14
AD3 15
AD4 16
AD5 17
AD6 18
AD7 19
Vss 20
21 PA0
22 PA1
23 PA2
24 PA3
25 PA4
26 PA5
27 PA6
28 PA7
29 PB0
30 PB1
31 PB2
32 PB3
33 PB4
34 PB5
35 PB6
36 PB7
37 PC0
38 PC1
39 PC2
40 Vcc

TMP8155P

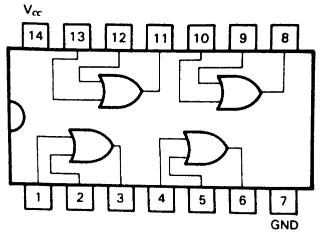
SEMICONDUCTORS


Vcc
8
7
6
5
1
2
3
4
GND

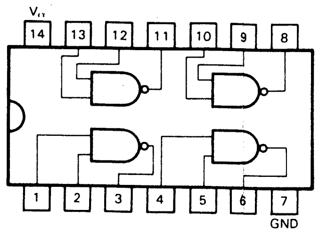
NJM4556D
NJM4558D
LF412CN


BALANCE
1
INPUT
2
INPUT
3
V-
4
8
NC
7
V+
6
OUTPUT
5
BALANCE

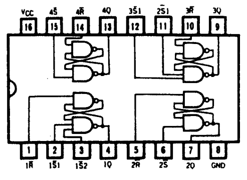
LM318N
LF411CN


Vcc
14
13
12
11
10
9
8
1
2
3
4
5
6
7
GND

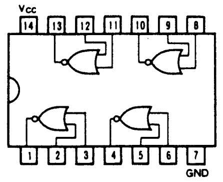
SN74LS32N


Vcc
14
13
12
11
10
9
8
1
2
3
4
5
6
7
GND

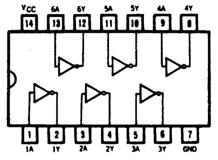
SN74LS00N



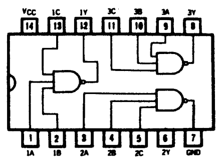
SN74LS279N



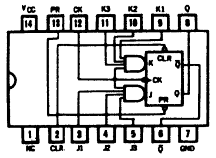
SN74LS02N



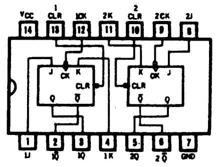
SN74LS04N



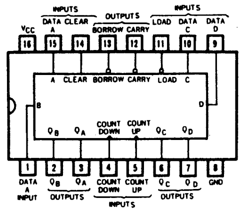
SN74LS10N



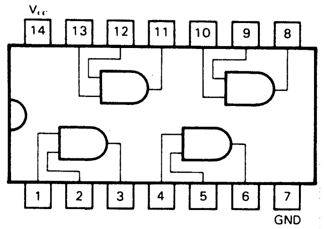
SN74LS74AN



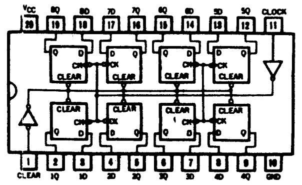
SN74LS107AN



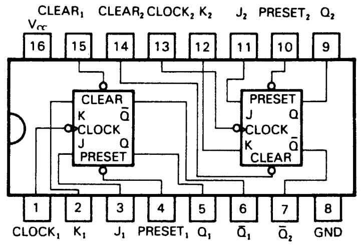
SN74LS193N


Vcc
14
13
12
11
10
9
8
1
2
3
4
5
6
7
GND

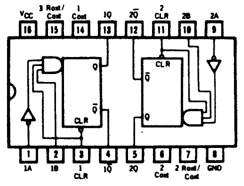
SN74LS08N



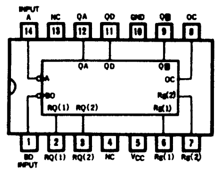
SN74LS273N


CLEAR₁
CLEAR₂ CLOCK₂ K₂
J₂
PRESET₂
Q₂
Vcc
16
15
14
13
12
11
10
9
CLEAR
K
CLOCK
J
PRESET
PRESET
J
CLOCK
K
CLEAR
1
2
3
4
5
6
7
8
CLOCK₁
K₁
J₁
PRESET₁
Q₁
GND

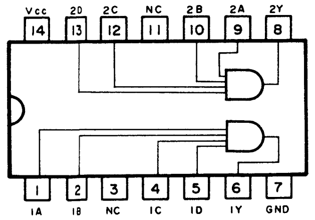
SN74LS112N
SN74LS112AN



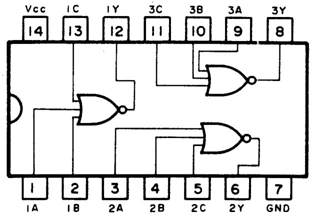
SN74LS123N



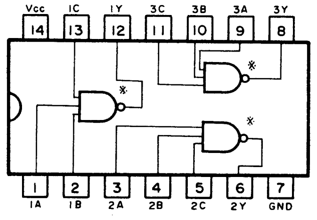
SN74LS90N


Vcc
2D
2C
NC
2B
2A
2Y
1A
1B
NC
1C
1D
1Y
GND

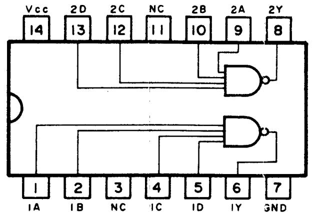
SN74LS21N


Vcc
1C
1Y
3C
3B
3A
3Y
1A
1B
2A
2B
2C
2Y
GND

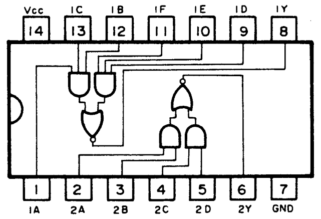
SN74LS27N


Vcc
1C
1Y
3C
3B
3A
3Y
1A
1B
2A
2B
2C
2Y
GND

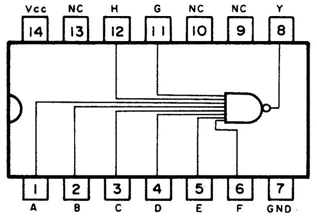
SN74LS12N


Vcc
2D
2C
NC
2B
2A
2Y
1A
1B
NC
1C
1D
1Y
GND

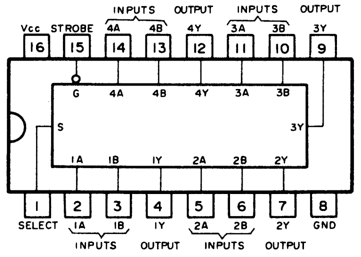
SN74LS20N


Vcc
1C
1B
1F
1E
1D
1Y
1A
2A
2B
2C
2D
2Y
GND

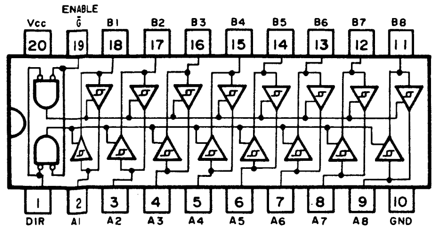
SN74LS51N


Vcc
NC
H
G
NC
NC
Y
A
B
C
D
E
F
GND

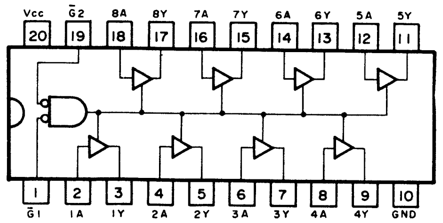
SN74LS30N


INPUTS
OUTPUT
INPUTS
OUTPUT
Vcc
STROBE
4A
4B
4Y
3A
3B
3Y
SELECT
1A
1B
1Y
2A
2B
2Y
GND

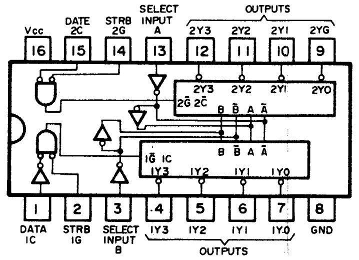
SN74LS157


ENABLE
Vcc
G
B1
B2
B3
B4
B5
B6
B7
B8
DIR
A1
A2
A3
A4
A5
A6
A7
A8
GND

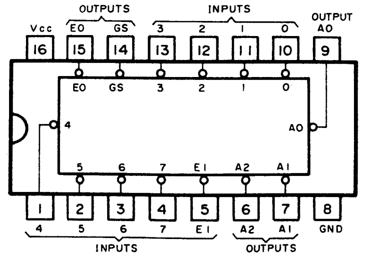
SN74LS245N


Vcc
G2
8A
8Y
7A
7Y
6A
6Y
5A
5Y
G1
1A
1Y
2A
2Y
3A
3Y
4A
4Y
GND

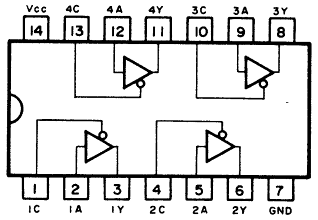
SN74LS465N


SELECT INPUT A
OUTPUTS
Vcc
DATA 2C
STRB 2G
2Y3
2Y2
2Y1
2Y0
DATA 1C
STRB 1G
SELECT INPUT B
1Y3
1Y2
1Y1
1Y0
GND
OUTPUTS

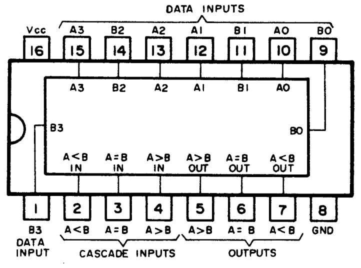
SN74LS155N


OUTPUTS
INPUTS
OUTPUT
Vcc
EO
GS
3
2
1
0
A0
4
5
6
7
EI
A2
A1
GND
INPUTS
OUTPUTS

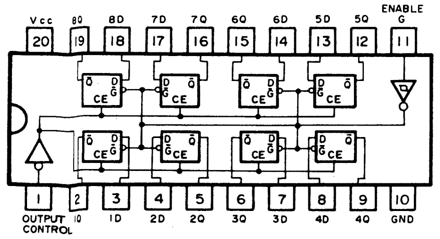
SN74LS148N


Vcc
4C
4A
4Y
3C
3A
3Y
1C
1A
1Y
2C
2A
2Y
GND

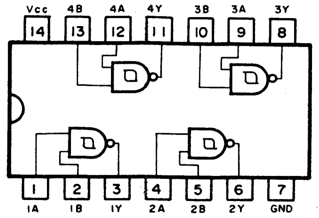
SN74LS125AN


DATA INPUTS
Vcc
A3
B2
A2
A1
B1
A0
B0
B3
A<B IN
A=B IN
A>B IN
A>B OUT
A=B OUT
A<B OUT
GND
DATA INPUT
CASCADE INPUTS
OUTPUTS

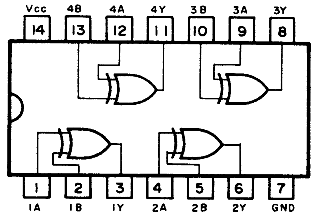
SN74LS85N


ENABLE G
Vcc
8Q
8D
7D
7Q
6Q
6D
5D
5Q
OUTPUT CONTROL
1Q
1D
2D
2Q
3Q
3D
4D
4Q
GND

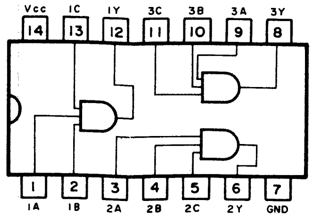
SN74LS373N


Vcc
4B
4A
4Y
3B
3A
3Y
1A
1B
1Y
2A
2B
2Y
GND

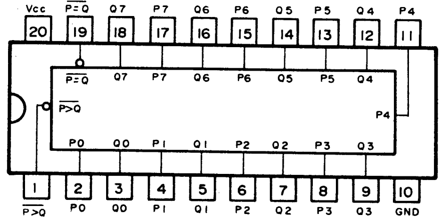
SN74LS132N


Vcc
4B
4A
4Y
3B
3A
3Y
1A
1B
1Y
2A
2B
2Y
GND

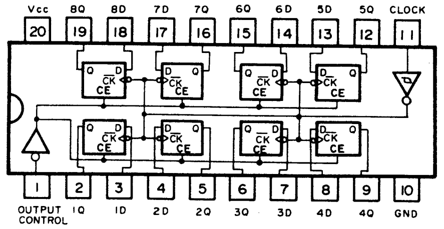
SN74LS86N


Vcc
1C
1Y
3C
3B
3A
3Y
1A
1B
2A
2B
2C
2Y
GND

SN74LS11N


Vcc
P=Q
Q7
P7
Q6
P6
Q5
P5
Q4
P4
P>Q
P0
Q0
P1
Q1
P2
Q2
P3
Q3
GND

SN74LS682 (J, N)
SN74LS684 (J, N)


Vcc
8Q
8D
7D
7Q
6Q
6D
5D
5Q
CLOCK
OUTPUT CONTROL
1Q
1D
2D
2Q
3Q
3D
4D
4Q
GND

SN74LS374N